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OPERATION AND SERVICE MANUAL

1986

MODEL 446A 1.25 MHz SOURCE OPERATIONS AND SERVICE MANUAL

MP MASTER

WEINSCHEL ENGINEERING CO., INC.
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GAITHERSBURG, MD 20877

REVISION INFORMATION IS LOCATED AT THE
REAR OF THIS MANUAL.

MODEL 446A 1.25 MHz SOURCE
OPERATIONS AND SERVICE MANUAL

IM188

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Gaithersburg, Maryland
1986

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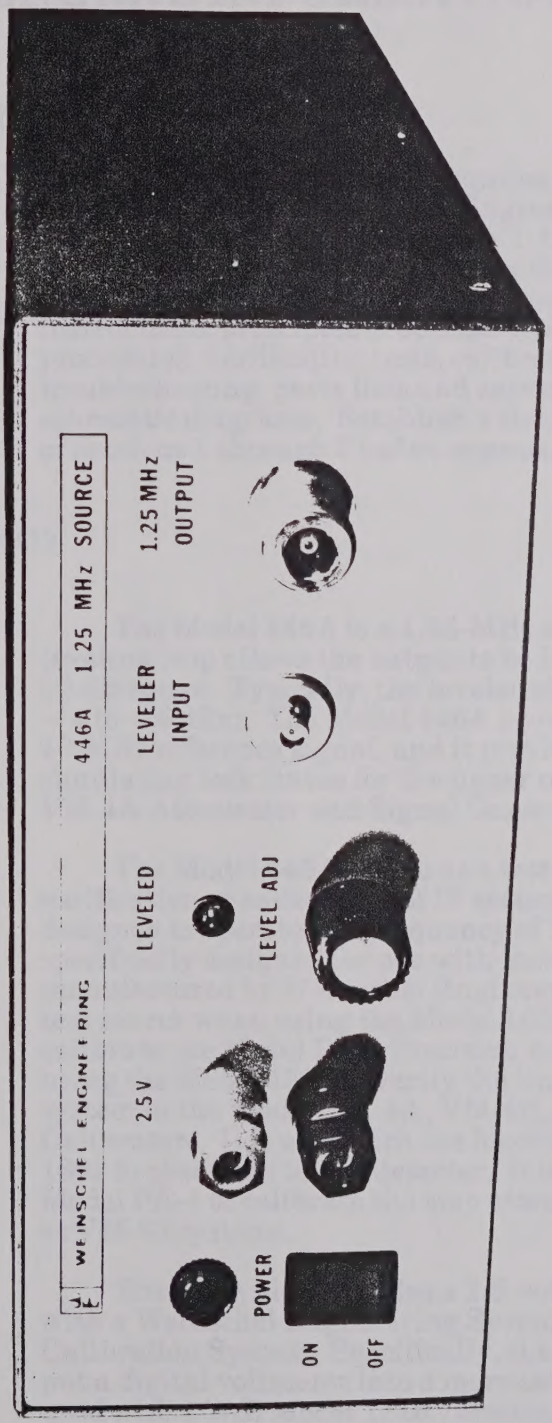


Figure 1-1. Weinschel Engineering Model 446A 1.25 MHz Source

SECTION 1
GENERAL INFORMATION

1.1 USING THIS MANUAL

This manual provides operation and maintenance information for the Weinschel Engineering Model 446A 1.25 MHz Source shown in Figure 1-1. The ten sections of the manual provide information on the following subjects: general information, installation procedures, operating instructions, principles of operation, maintenance procedures, verification tests, calibration procedures, troubleshooting, parts lists and assembly drawings, and schematic diagrams. Establish a thorough understanding of Sections 1 through 3 before operating the Model 446A.

1.2 A DESCRIPTION OF THE MODEL 446A

The Model 446A is a 1.25-MHz signal source with a leveling loop allows the output to be leveled through a 10-dB range. Typically, the leveled signal is in a range of −4 to +6 dBm. The Model 446A provides a coherent 10-MHz reference signal, and it provides a means of simulating lock status for the upper unit of a W/E Model VM-4A Attenuator and Signal Generator Calibrator.

The Model 446A serves as a test source for the verification or calibration of IF systems and devices designed to operate at a frequency of 1.25 MHz. It is specifically designed for use with many instruments manufactured by Weinschel Engineering. It serves as the test source when using the Model 1830 Voltage Doubler to calibrate the Model PA-4 Precision Attenuator, or when using the Model 1830 to verify the linearity of the IF system in the Model VM-4A, VM-4B, or VM-24 Calibrators. It is used with the Model PA-4 or the Model 1809 to check the linear detector. It is also used with the Model PA-4 to calibrate the step attenuators in the VM-4 or VM-24 systems.

The 446A also provides a 2.5-volt dc source for use with a Weinschel Engineering System II Power Meter Calibration System. Specifically, the 2.5 volts is used to put a digital voltmeter into a more sensitive range when used with a W/E Model 1110 Terminating Thermistor Mount and a W/E Model 1806 Type IV Bridge.

1.3 MODEL 446A SPECIFICATIONS

Table 1-1 contains the Model 446A's electrical, physical, and environmental specifications. Figure 1-2 illustrates its physical dimensions.

Table 1-1. MODEL 446A SPECIFICATIONS

Item	Specification
Output Frequency:	1.25 MHz
Output Level:	+ 13 dBm nominal
Spectral Purity:	– 50 dBc in 10 Hz bandwidth, 60 Hz from carrier.
Short-Term Stability:	± 0.001 dB (5 min. with ambient temperature variation ≯ 0.1°C)
Reference Output:	10 MHz
Reference Voltage:	2.5 Vdc
Operating Temperature Range:	25 °C ± 5°
Size:	8.89 cm × 21.27 cm × 30.48 cm (3.5in × 8.375 in × 12 in)
Weight:	8 lbs (3.6 kg) net 14 lbs (6.4 kg) shipping
Power:	100/120/220/240 Vac ± 10%, 50 to 60 Hz

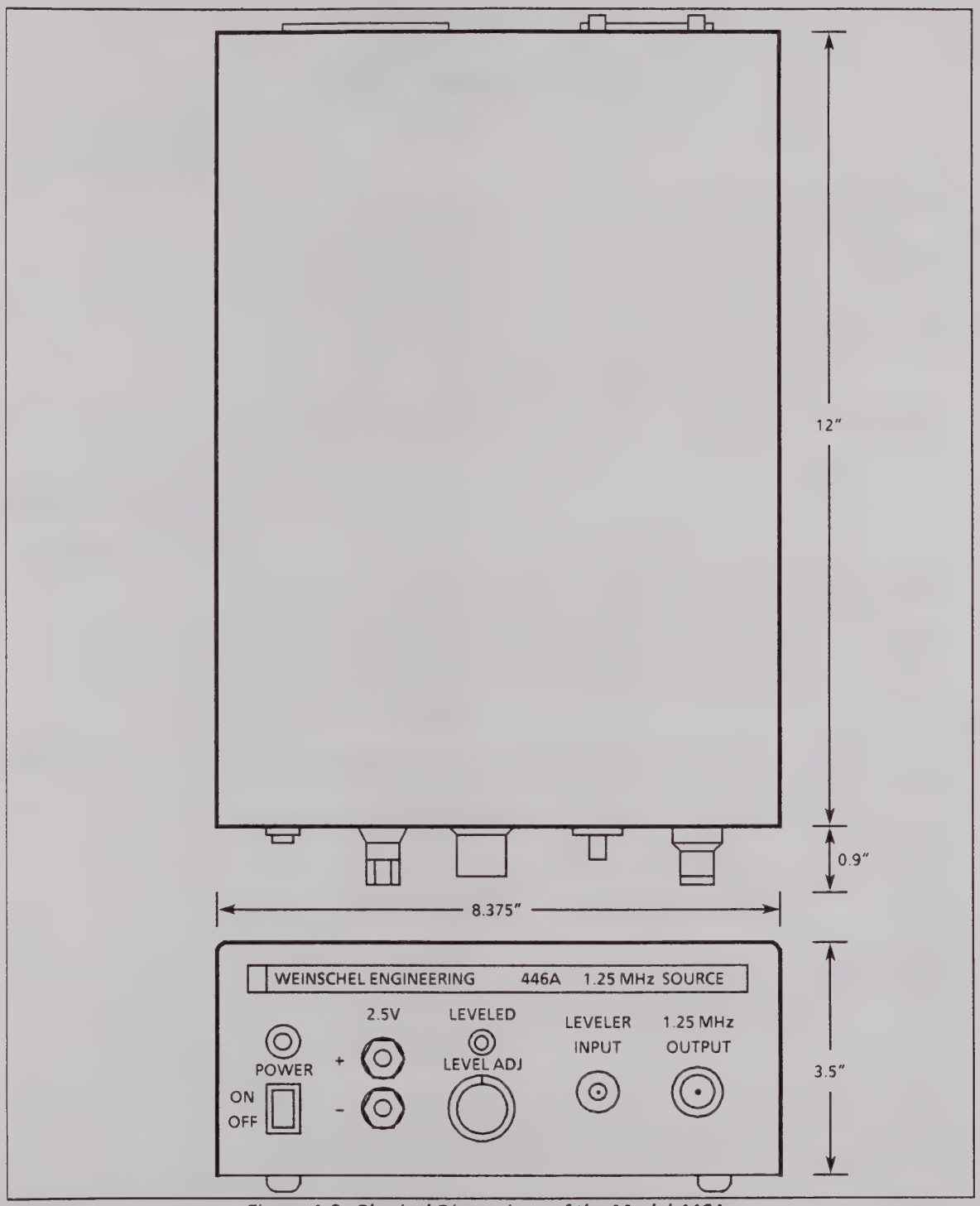


Figure 1-2. Physical Dimensions of the Model 446A

SECTION 2
INSTALLATION

2.1 INSTALLING THE MODEL 446A

Installation of the Model 446A consists of unpacking and inspecting the unit, ensuring that its power and environmental requirements are met, setting the 446A for the proper line voltage, ensuring that the correct line voltage fuse has been installed, and connecting the 446A to its ac power source. The following paragraphs discuss these operations and also provide information on reshipment and storage. Section 3 discusses the connectors, switches, and indicators not involved in the installation process.

2.2 UNPACKING AND INSPECTING THE MODEL 446A

UNPACKING

Weinschel Engineering ships the Model 446A cushioned between molded-in-place expanded plastic pads in a double-walled carton. After unpacking the unit, retain the shipping container and packing material until the unit has been thoroughly inspected to ensure that reshipment will not be necessary. Perform the following initial inspection:

INSPECTION

A. Carefully inspect the outside of the shipping container for discoloration, stains, charring, or other signs of exposure to excessive heat, moisture, or liquid chemicals. Check for any physical damage to the shipping container such as dents, snags, rips, crushed sections or areas, or similar signs of excessive shock or careless handling.

B. Remove the unit from the shipping container. Check that an AC Power Cable assembly was included with the unit. If this item is missing, contact the manufacturer or the manufacturer's local representative.

C. Carefully inspect the unit looking for dents, deep scratches, damaged or loose connectors, or any other signs of physical abuse or careless handling.

DAMAGE

If damage is found, forward an immediate request to the delivering carrier to perform an inspection and to prepare a concealed-damage report. Do not destroy any packing material until it has been examined by an agent

of the carrier. Concurrently, report the nature and extent of damage to Weinschel Engineering, giving the equipment model and serial numbers, so that necessary action can be taken. Under U.S. shipping regulations, damage claims must be collected by the consignee. Do not return the equipment to Weinschel Engineering until a claim for damages has been established.

2.3 ACCESSORIES

The items supplied with the Model 446A are an AC Power Cable assembly (P/N 68-21) and an Operations and Service Manual (P/N IM 188).

2.4 PREPARATION FOR RESHIPMENT OR STORAGE

RESHIPMENT

Use the best packaging materials available to protect the unit during storage or reshipment. When possible, use the original packing container and cushioning material. If the original packing materials are not available, use the following procedure:

A. Wrap the instrument in sturdy paper or plastic.

B. Place the wrapped instrument in a strong shipping container and place a layer of shock-absorbing material (3/4-inch minimum thickness) around all sides of the unit to provide a firm cushion and to prevent movement inside the container.

C. If shipping the unit for service or recalibration, attach a tag to indicate:

1. model and serial numbers,
2. service required,
3. description of malfunction,
4. return address, and
5. authorization to conduct repairs or to recalibrate.

D. Thoroughly seal the shipping container and mark it **FRAGILE**.

E. Ship to:

Weinschel Engineering
1 Weinschel Lane
Gaithersburg, MD 20877

STORAGE

When storing the 446A for extended periods, follow the packing instructions contained in this paragraph to prevent damage to internal circuitry. The safe limits for storage environment are:

Temperature:	−67° to +167° F (−55° to +75° C)
Humidity:	less than 95%
Altitude:	less than 40,000′ (12,192 m)

2.5 MODEL 446A POWER AND ENVIRONMENTAL REQUIREMENTS

The Model 446A requires a line voltage of 100, 120, 220, or 240 volts ac ±10% at a line frequency of 50 to 60 Hz. To operate within specifications, the 446A should be operated at an ambient temperature of 68° to 86° Fahrenheit (25° C ±5°).

2.6 PREPARING THE 446A FOR THE CORRECT LINE VOLTAGE

Figure 2-1 shows the location of the Fuse Holder and Power Input assembly on the rear panel of the 446A. The assembly contains a three-prong ac power input connector, a fuse holder, and and a voltage selector circuit board. A sliding plastic window prevents access to the fuse holder when the power cord is connected.

SET LINE VOLTAGE

Before connecting the Model 446A to ac power, examine the voltage selector circuit board to make certain that the 446A has been set to the correct line voltage (see Figure 2-2, Step 3). To reset the 446A to operate at the correct line voltage, pull out the small circuit board in the fuse holder assembly and reinsert it in the proper position to operate at 100, 120, 220, or 240 volts ac. Figure 2-2 shows how to remove the voltage selection circuit board and reinsert it in the correct position. The factory line voltage setting is printed on the Power Identification label (see Figure 2-1).

CHECK FUSE

Make certain that the 446A contains the correct fuse for the line voltage being used. Use a 1-ampere or a 1/2-ampere fast-blow fuse, depending on the line voltage. Table 2-1 shows the correct fuse to use for each line voltage.

CONNECT POWER CORD

With the correct fuse in place, slide the plastic window to the right and connect the three-conductor power cord (P/N 068-21) supplied with the 446A. Operate the 446A from a three-conductor grounded power outlet that supplies the correct line voltage.

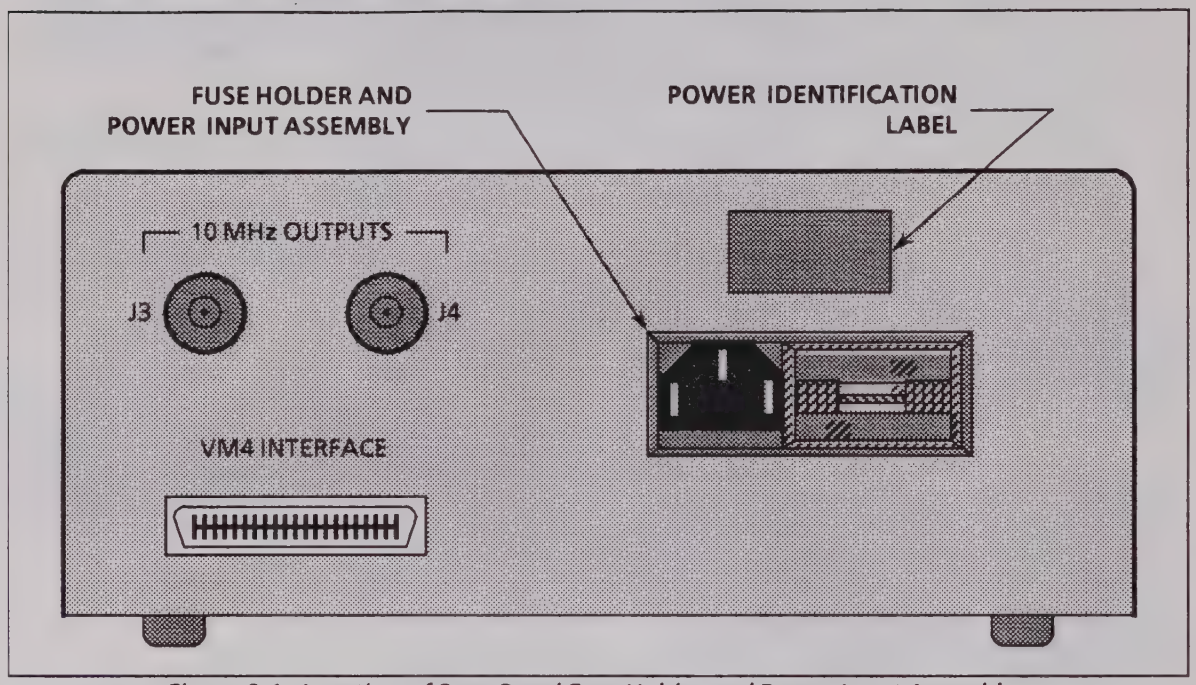


Figure 2-1. Location of Rear-Panel Fuse Holder and Power Input Assembly

Table 2-1. LINE VOLTAGE FUSE REQUIREMENTS FOR THE MODEL 446A

Line Voltage	Fuse Requirement	Part Number
100 or 120 volts ac	1 amp fast-blow	052-1-1
220 or 240 volts ac	1/2 amp fast-blow	052-1-1/2

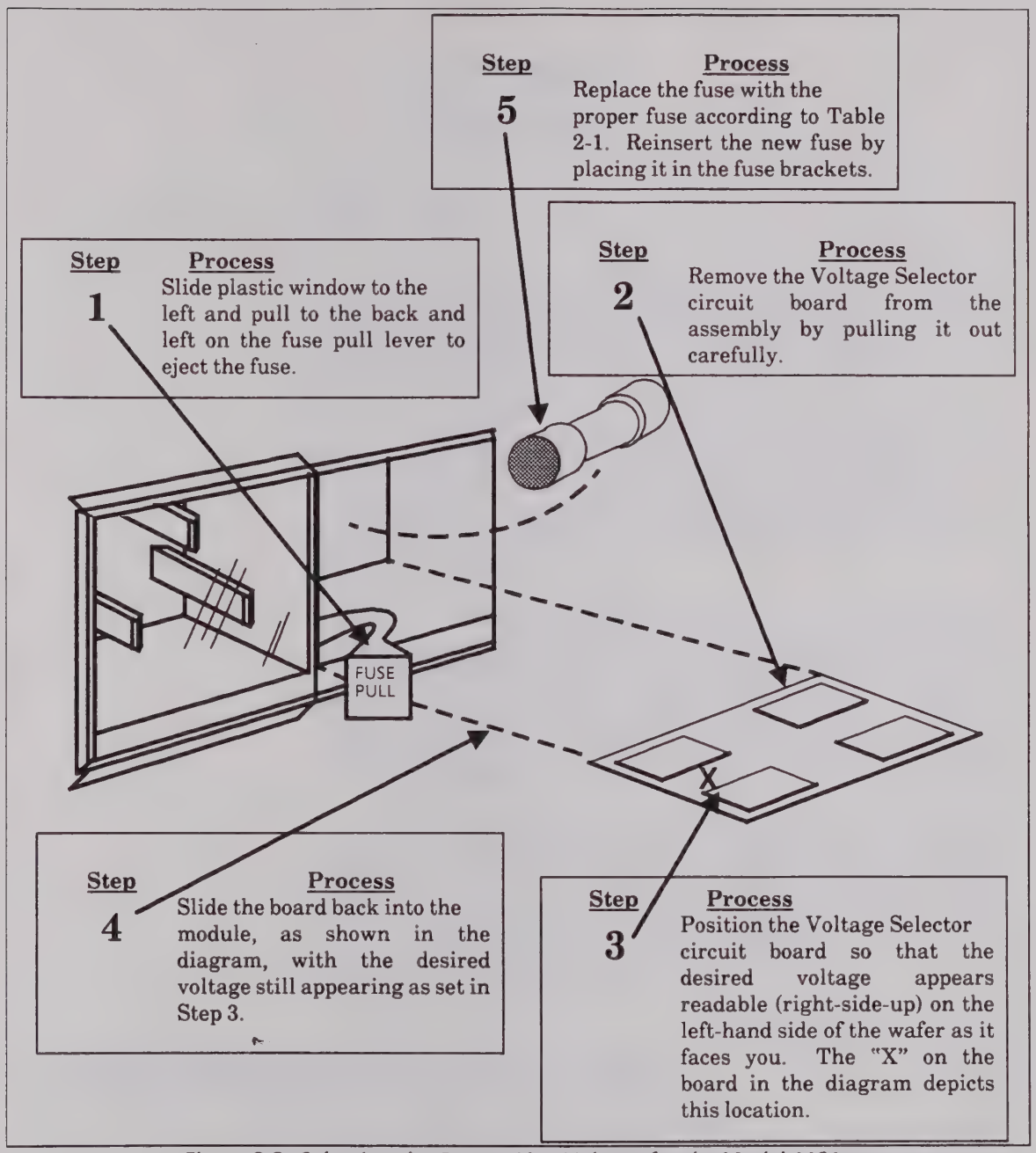

Step 5
Process
Replace the fuse with the proper fuse according to Table 2-1. Reinsert the new fuse by placing it in the fuse brackets.
Step 1
Process
Slide plastic window to the left and pull to the back and left on the fuse pull lever to eject the fuse.
Step 2
Process
Remove the Voltage Selector circuit board from the assembly by pulling it out carefully.
FUSE PULL
Step 4
Process
Slide the board back into the module, as shown in the diagram, with the desired voltage still appearing as set in Step 3.
Step 3
Process
Position the Voltage Selector circuit board so that the desired voltage appears readable (right-side-up) on the left-hand side of the wafer as it faces you. The "X" on the board in the diagram depicts this location.

Figure 2-2. Selecting the Correct Line Voltage for the Model 446A

SECTION 3
OPERATION

3.1 OPERATING THE MODEL 446A

When powered up, the Model 446A supplies a 1.25-MHz test signal at its **1.25 MHz OUTPUT** connector. Feeding a portion of the 446A's output signal back into the **LEVELER INPUT** connector completes the 446A's leveling loop to provide a leveled test signal.

The **LEVEL** adjust knob varies the leveled output over a range of 10 dB to provide a leveled signal at approximately −4 to +6 dBm. Since the leveling loop operates over a specific range, the **LEVELED** indicator shows when the **LEVEL ADJ** knob is set in the range where leveling takes place.

The rear-panel **10 MHz OUTPUT** connectors supply a phase-coherent 10-MHz reference signal, and the rear-panel **VM4 INTERFACE** connector provides a means of simulating signal-lock for the upper unit of the Model VM-4A. The **2.5V** terminals on the front panel supply a dc voltage that is useful when using a thermistor mount with a Type IV Bridge.

For further information, Paragraph 3.2 individually describes each front-panel switch, indicator, connector, and control on the Model 446A; Paragraph 3.3 describes each rear-panel connector. Paragraph 3.4 explains how to connect the leveling loop, and Paragraph 3.5 shows how to connect the reference voltage to the Weinschel Engineering System II.

3.2 FRONT-PANEL SWITCHES, INDICATORS, CONNECTORS, AND CONTROLS

This paragraph discusses the front panel switches, indicators, connectors, and controls on the Model 446A. Figure 3-1 shows the location of each item. Refer to Appendix A for further information about making proper connections to front panel connectors.

3.2.1 POWER Switch

Figure 3-1 shows the location of the **POWER** switch (S1). This is a double pole, double throw rocker-type switch. When turned off, it completely isolates the 446A from the ac line.

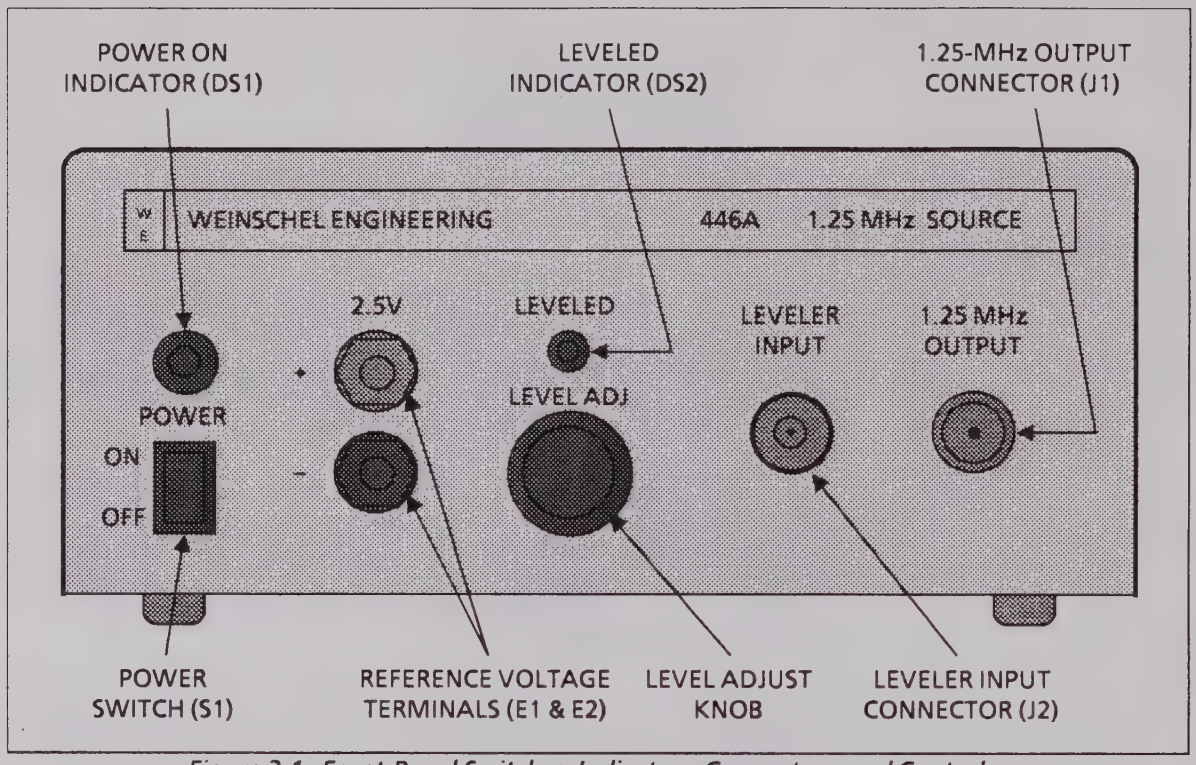


Figure 3-1. Front-Panel Switches, Indicators, Connectors, and Controls

3.2.2 Power On Indicator

The power on indicator (DS1), located as shown in Figure 3-1, is a red indicator lamp that is lit when power is on.

3.2.3 1.25 MHz OUTPUT Connector

The front-panel connector labeled **1.25 MHz OUTPUT** is a Type N female connector that outputs the 1.25-MHz sine-wave test signal generated by the 446A.

3.2.4 LEVELER INPUT Connector

The front-panel connector labeled **LEVELER INPUT** is an SMA female connector. Feeding a portion of the 446A's 1.25-MHz output back into this connector levels the output, ensuring that the signal remains at a fixed power level. Refer to Paragraph 3.4 for further information on connecting the leveling loop.

3.2.5 LEVEL ADJUST Knob

The knob on the front panel labeled **LEVEL ADJ** controls the signal level out of the **1.25 MHz OUTPUT**. Through ten turns of the knob, a leveled output signal can be varied through a range of 10 dBm.

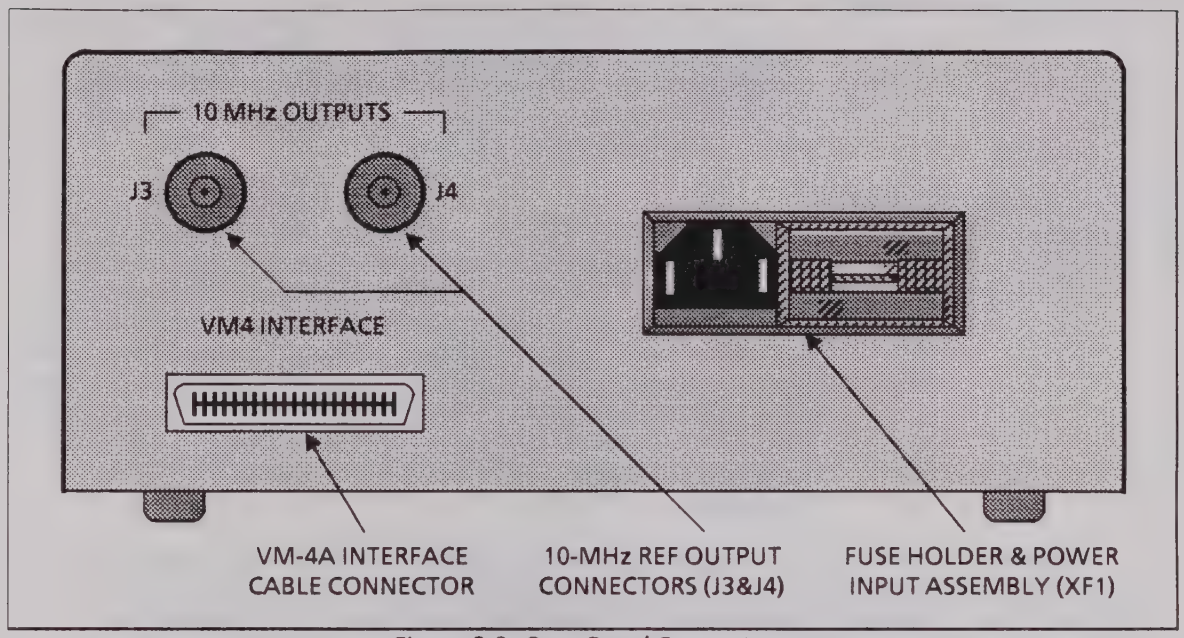


Figure 3-2. Rear-Panel Connectors

3.2.6 LEVELED Indicator

The green front-panel LED labeled **LEVELED** lights when the leveling circuit is functioning. Since the leveling circuit in the 446A operates in a limited range, the **LEVELED** indicator is needed to indicate when the **LEVEL ADJ** knob is set in the range where leveling takes place.

3.2.7 2.5V Reference Voltage

Figure 3-1 shows the location of the two **2.5V** reference voltage terminals (E1 and E2). This 2.5-volt dc source can serve as a bucking voltage to put a digital voltmeter into a more sensitive range. Paragraph 3.5 details a specific application where this bucking voltage is used with a Model 1110 thermistor mount, a Model 1806 Type IV Bridge, and a digital voltmeter.

3.3 REAR-PANEL CONNECTORS

This paragraph discusses the rear-panel connectors on the Model 446A. Figure 3-2 shows the location of each connector. Refer to Appendix A for further information about making proper connections to the rear panel connectors.

3.3.1 10-MHz OUTPUT Connectors

The two rear-panel connectors in Figure 3-2 labeled **10 MHz OUTPUTS** (**J3** and **J4**) are SMA female connectors that provide a 10-MHz TTL reference signal. The reference signal is phase-coherent with the front-panel 1.25-MHz output signal.

3.3.2 VM4 INTERFACE Connector

The **VM4 INTERFACE** connector is used to simulate a signal-lock condition when testing the upper unit of a VM-4A system. Figure 3-2 shows the location of this connector on the rear panel. To obtain a signal-lock indication on a VM-4A system, remove the interface cable from connector **J2** on the rear panel of the HO-2 unit, and plug this cable into the **VM4 INTERFACE** connector on the 446A. Turn on the 446A, and then the VM-4A. The **LOCKED** LED on the VM-4A's front panel will illuminate.

When testing the upper unit of a VM-4B or VM-24 system, the signal-lock condition must be obtained by other means. The VM-4B and VM-24 Operation and Service manuals provide instructions for obtaining a signal-lock indication on these units. The 446A does not respond to a VM-4A system that has had a microprocessor upgrade installed. Such a system must acquire signal lock in the same manner as a VM-4B.

3.3.3 Fuse Holder and Power Input Assembly

Figure 3-2 shows the location of the Fuse Holder and Power Input assembly (XF1). This assembly contains the line fuse and accepts the power cord. Paragraph 2.6 describes how to set this assembly for the correct line voltage, and how to determine the correct fuse rating.

3.4 LEVELING THE 446A

When a portion of the Model 446A's **1.25 MHz OUTPUT** signal is fed back into the **LEVELER INPUT** connector, the 446A's leveling loop circuitry is brought into operation, and the 446A maintains a fixed output level within ± 0.001 dB.

Figure 3-3 illustrates the typical method of completing the leveling loop. The output signal feeds into a 50-ohm power splitter (Weinschel Engineering Model 1870A). One side of the splitter connects to the 446A's **LEVELER INPUT**; the other side of the splitter furnishes the test signal. The test signal feeds through the appropriate amount of padding into a calibration device such as the Weinschel Engineering Model PA-4.

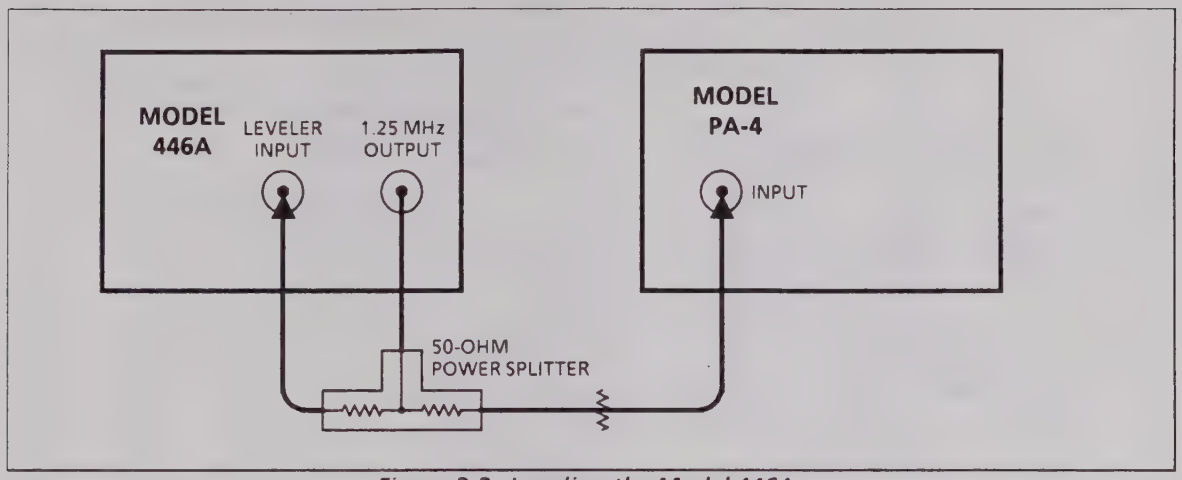


Figure 3-3. Leveling the Model 446A

The power splitter divides the 446A's **1.25 MHz OUTPUT** signal in half, reducing it by approximately 6 dB. Typically, this puts the leveled signal into a range of −4 to +6 dBm. This makes the 446A ideal for furnishing a 0-dBm test signal.

Figure 3-4 illustrates how to level the 446A when using it to furnish a test signal for the Weinschel Engineering Model 1830 Voltage Doubler. Since the Model 1830 contains an internal power splitter, a signal for the 446A's **LEVELER INPUT** can be taken directly from the 1830's **REF** output. When testing or calibrating the upper unit (IF substitution loop) of a Model VM-4A or VM-4B system, a fixed-level reference IF signal is tapped from the 1830's **REF** output with the 200-ohm power divider furnished with the Model 1830.

3.5 USING THE REFERENCE VOLTAGE FOR MORE ACCURATE MEASUREMENTS

When using the Weinschel Engineering System II Power Meter Calibration System to measure RF power, a digital voltmeter measures the change in voltage across the voltmeter terminals of the Model 1806. When the RF power is small, the change in voltage at the 1806's terminals is small. In this situation, the voltmeter magnifies measurement uncertainties, because the large voltmeter measurement scale has limited resolution. The Model 446A can reduce these uncertainties, by adding a bucking voltage in series with the voltmeter so that it can be set to a smaller measurement scale.

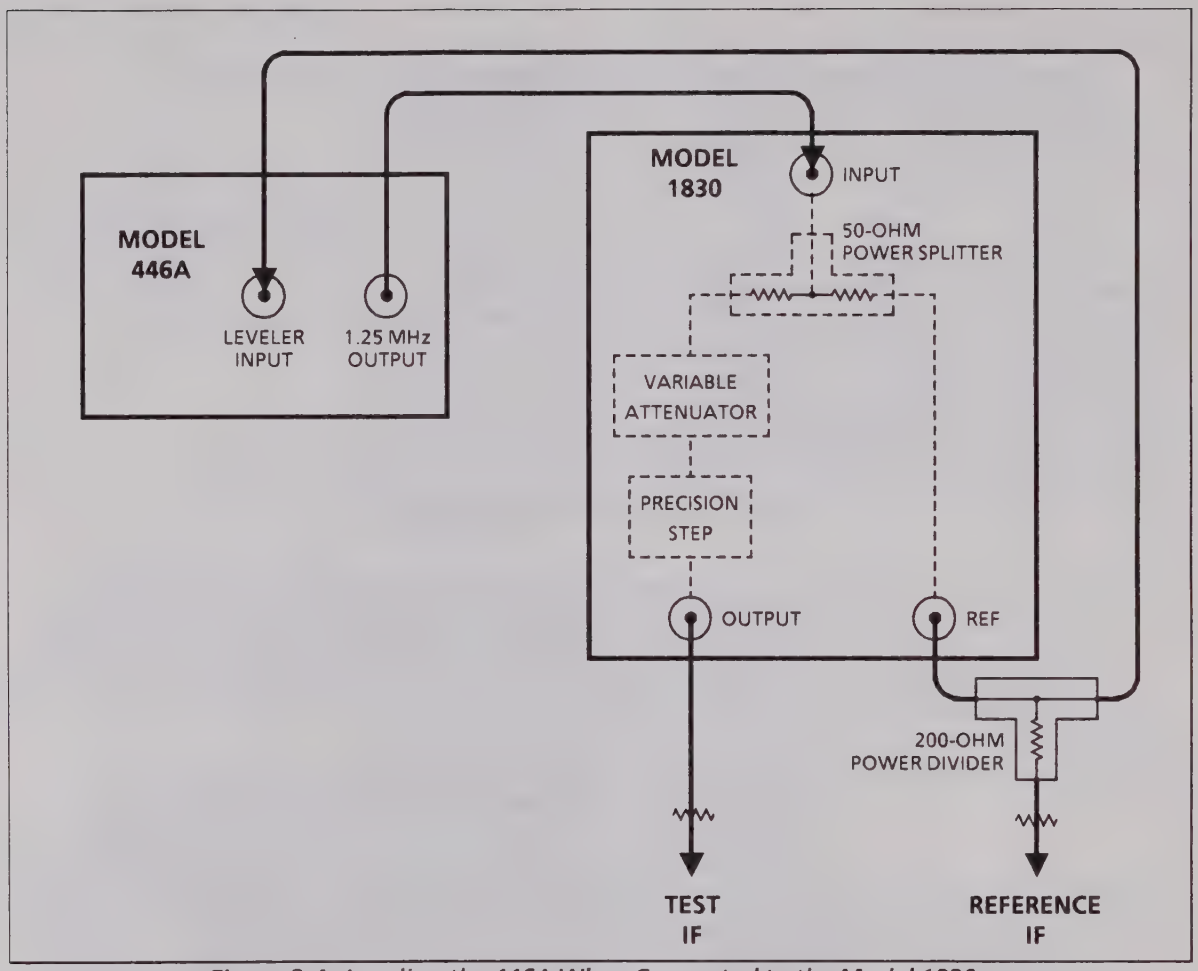


Figure 3-4. Leveling the 446A When Connected to the Model 1830

Figure 3-5 shows how the 2.5-volt reference on the 446A can be connected to the Model 1806 to bring the voltmeter into a more favorable measurement range. When the 2.5-volt reference is connected to System II, use the following method to calculate RF power:

A. With no RF power applied and the double-pole double-throw switch in the V_1 position, record the voltmeter reading as V_1.

B. With no RF power applied and the switch in the V_D position, record the voltmeter reading as V_{D1}. This is the difference between the voltage from the 1806 and the reference voltage.

C. With the switch still in the V_D position, apply RF power and record the voltmeter reading as V_{D2}. This is the difference between the voltage from the 1806 and the reference voltage, including the proportional RF power effect on the 1806's bridge circuit.

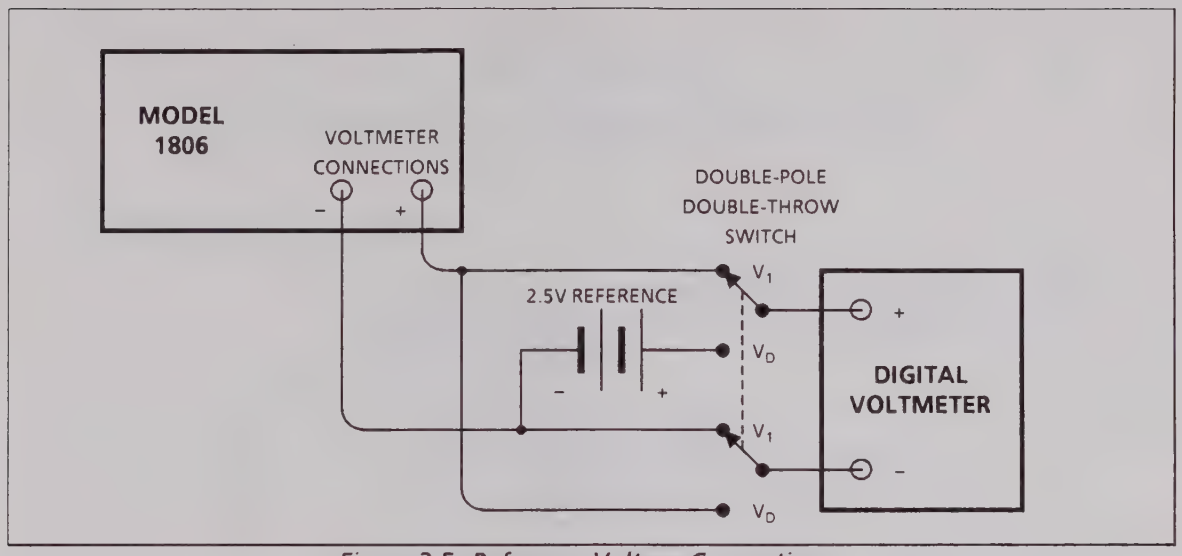


Figure 3-5. Reference Voltage Connections

D. Use the following formula to calculate the dc substituted power:

$$P_{dc} = \frac{\left(2V_1 - V_{D2} + V_{D1}\right)\left(V_{D2} - V_{D1}\right)}{R_0}$$

Where:

V_1 = 1806 bridge output measured with no power applied,
V_{D1} = Reference voltage minus the 1806 output with no RF,
V_{D2} = Reference voltage minus the 1806 output with RF,
R_0 = Mount operating resistance, and
P_{dc} = Proportional amount of dc substituted power.

E. Use the following formula to calculate the RF power using the mount calibration factor:

$$P_{RF} = \frac{P_{dc}}{K_1}$$

Where:

P_{RF} = Level of RF power applied to the thermistor,
P_{dc} = Level of dc substituted power from previous equation, and
K_1 = Terminating mount calibration factor which is traceable to NBS.

For further details on this specific application of the Model 446A's reference voltage, see the *Model 1806 Dual NBS Type IV Power Meter Operation and Service Manual.*

SECTION 4
PRINCIPLES OF OPERATION

4.1 MODEL 446A CIRCUITRY

The circuitry of the Model 446A is depicted in the schematic diagram (Figure 10-1). It consists of the following sections:

A. Signal Generator
B. Leveling Loop
C. Lock Simulator for the VM-4A
D. Power Supply

The block diagram in Figure 4-1 illustrates the signal generator and leveling loop circuitry. A 10-MHz crystal oscillator generates a signal which is fed to the rear panel and also divided by 8 to produce a 1.25-MHz signal. The signal passes through a variable-gain amplifier whose output level is determined by a control voltage. The variable gain amplifier drives the output amplifier stages to provide a sine wave signal at the required signal level.

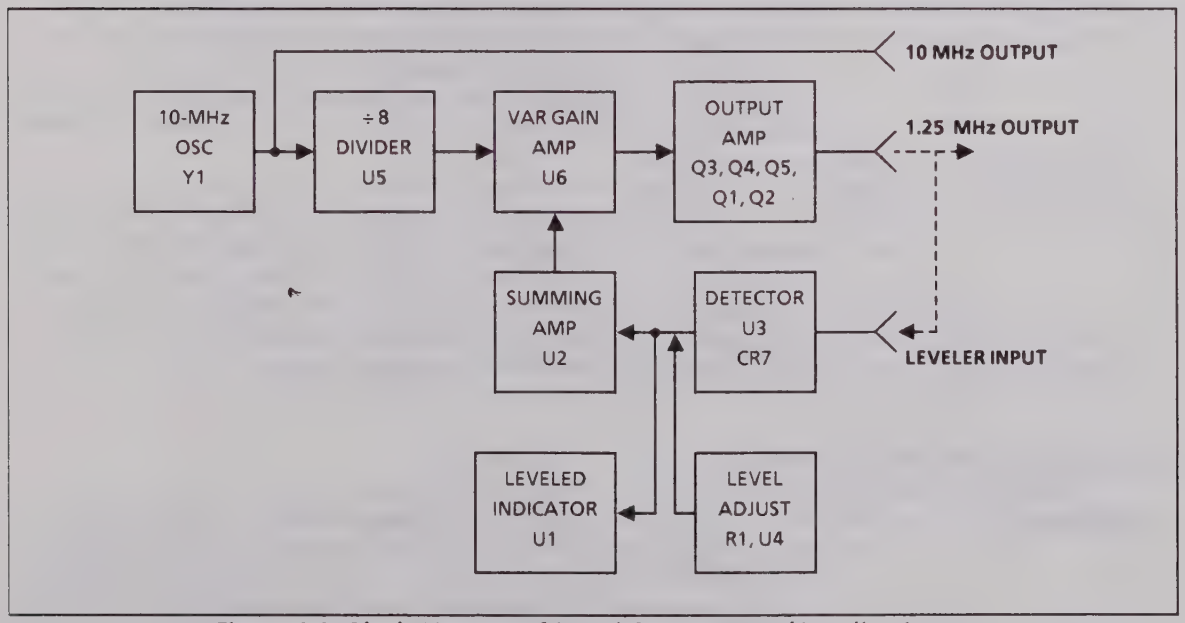


Figure 4-1. Block Diagram of Signal Generator and Leveling Loop

When a portion of the output signal is fed back into the detector circuit, leveling takes place. The voltage produced by the detector and the voltage from the level adjust control are summed to produce a control voltage for the variable-gain amplifier.

For the circuit descriptions that follow, refer to Figure 10-1, the schematic diagram of the 446A.

4.2 GENERATING A 1.25-MHz SIGNAL

OSCILLATOR AND DIVIDER

The crystal oscillator designated as Y1 on the shematic diagram (Figure 10-1, Sheet 1) generates a 10-MHz TTL signal . This signal is fed to rear-panel connectors J1 and J2 through the driver U11, and also to U5 (Figure 10-1, Sheet 2). U5 divides the signal by 8 to produce 1.25 MHz.

VARIABLE GAIN AMPLIFIER

The transistors of U6 are connected as a variable-gain differential amplifier with input and output buffers. The variable-gain amplifier provides a means to control the amplitude of the signal. A control voltage into the base of U6E determines the signal level out of the emitter of U6C. For calibration of the PC board, the jumper JB1 can be connected between R8 and potentiometer R67 to provide a fixed control voltage.

OUTPUT AMPLIFIER

The signal from U6C passes through Q3 into a cascode amplifier consisting of transistors Q4 and Q5. This provides a high-level drive signal to the tank circuit of T1 and C15. The secondary of T1 provides a low-impedance signal that drives the next cascode amplifier, Q2 and Q1. The secondary of T2 provides a low-impedance output signal.

The feedback signal through L1, C9, and R25 is out of phase with the input signal to Q3 to reduce the signal components that are not 1.25 MHz. During calibration the jumper JB2 is used to remove the feedback circuit while adjusting transformers T1 and T2 for maximum output. JB2 is then reinstalled for the adjustment of L1.

4.3 LEVELING THE SIGNAL

DETECTOR

Signal leveling takes place when a portion of the front-panel **1.25 MHz OUTPUT** signal is fed back into the **LEVELER INPUT** connector. The **LEVELER INPUT** signal encounters the detector circuit consisting of CR7 and C36 (Figure 10-1, Sheet 2) which produces a dc voltage that is proportional to the signal level into U3.

LEVEL ADJUST

The output level of the 446A is controlled by the front panel **LEVEL ADJUST** control. The voltage across the **LEVEL ADJUST** potentiometer is held at a steady 6.9 volts by the zener diode CR10.

SUMMING AMPLIFIER

The level-adjust voltage and the voltage produced by the detector are summed by U2 to furnish a gain-control voltage to the base of the transistor U6E. A rise in the signal level into U3 produces a drop in the gain-control voltage out of U2 causing the variable-gain amplifier to reduce the signal back to its former level.

LEVELED INDICATOR

The voltage into U2 also goes into the inverting input of U1A and into the non-inverting input of U1B. These comparators sense when this voltage goes out of range. U1A senses an over-range condition, and U1B senses an under-range condition. When an out-of-range condition is sensed, one of the comparator outputs goes to ground. This cuts off the voltage to the front-panel **LEVELED** indicator. The range is determined by the voltage divider consisting of R35, R37, and R38.

4.4 SIMULATING LOCK FOR THE VM-4A

When testing the upper unit of a Weinschel Engineering VM-4A system, the interface cable that normally connects from the VM-4A unit to the HO-2 unit may be removed from the HO-2 unit and plugged into the **VM4 INTERFACE** connector of the 446A to simulate a signal lock condition. This interface connector is J1 on the 446A's PC board and is shown on the schematic diagram (Figure 10-1, Sheet 1).

To simulate lock, U13 and U14 latch the data sent by the VM-4A. When the VM-4A requests data, the latches merely return the same data. The output of each data latch is wired back to the input of the latch so that the data can be read back out onto the same bus.

When the VM-4A writes out data, Pin 34 of J1 (address line **A2**) is high, and a low-going strobe pulse (**ST8**) comes in at Pin 29 of J1. This results in a pulse into Pin 1 of U13 and U14 to clock the data into the latches.

When the VM-4A requests data, Pin 35 of J1 (address line **A1**) is high, and the low-going strobe pulse (**ST8**) comes in at Pin 29 of J1. This enables the outputs of the latches, putting the data on the data bus.

4.5 POWER SUPPLY

The power supply uses a bridge rectifier CR9 to convert the ac voltage from the power transformer T3 into dc (Figure 10-1, Sheet 1). The positive and negative dc from the bridge is filtered to supply the input of the +15 and −15 volt regulator IC's U8 and U9. Positive dc voltage from the bridge also supplies the input of the +5 volt regulator IC U7.

4.6 2.5-VOLT REFERENCE VOLTAGE

CR2 is a temperature stabilized zener diode that furnishes a regulated −6.9 volts at the test point TP6. U10 reduces this voltage by an amount determined by potentiometer R42 to furnish 2.5 volts at the front panel.

SECTION 5
MAINTENANCE

5.1 INTRODUCTION

The Model 446A IF Signal Source requires no preventive maintenance other than the normal handling and cleaning procedures discussed in Paragraph 5.3.

5.2 CONTACTING WEINSCHEL ENGINEERING ABOUT REPAIRS

Weinschel Engineering may be contacted about repairs or other matters via mail, telephone, wire, or cable at:

Weinschel Engineering
One Weinschel Lane
Gaithersburg, MD 20877
U.S.A.

Telex: ITT 440702 (WEIN UI) or
WU 89-8352(Weinschel Garg)

Call TOLL FREE: 800 638-2048
TOLL Call #: 301-948-3434

TELEFAX: 301-948-3625

5.2.1 In Warranty Repairs

An apparent malfunction of an instrument or component may be corrected over the phone by first contacting the area Weinschel representative or the Customer Service Department at the factory. Weinschel's representatives will direct you to the nearest authorized service center. Do not send the instrument or component to the factory without proper authorization. When it is necessary to return an item, state the symptoms, catalog and type number of component or instrument, and date of original purchase. Also, the Company name, your name, and phone number should be written on a card and taped to the item returned.

5.2.2 Out-of-Warranty Repairs

Should it become necessary to return an instrument or component for repair, follow the procedure described in Paragraph 5.2.1 prior to shiping. Within three working days after receipt at the factory, the unit will be evaluated

and a formal quotation will be supplied. Repair will begin when authorization is received in the form of a Purchase Order. Weinschel Engineering gives a 90-day guarantee on all out-of-warranty repairs.

5.2.3 Reshipment to Weinschel Engineering

Refer to Paragraph 2.4 for instructions on shipping a unit to Weinschel Engineering for repairs.

5.3 PREVENTIVE MAINTENANCE

While the 446A requires little preventive maintenance, it should not be subjected to physical abuse, severe mechanical shock, high humidity, or operating temperatures outside the specification range. The unit should be kept free of excessive dirt and dust, as these can interfere with normal heat dissipation and connector functions. Care should be taken to prevent physical strain on the interconnection cables, as damage here may not always be apparent.

To remove dirt or dust, use a slightly dampened lint-free cloth. Avoid use of cleaning solvents. Interior dust may be blown out using a low-pressure air blower. Occasionally check external cables and connectors for signs of cracked insulation and bent or worn pins.

CONNECTORS

Tests show that connectors must be clean for accuracy and stability. This requires inspection and cleaning of each connector immediately before use, and periodic inspection during use. If cleaning is necessary, use compressed air and a lint-free tissue. Where more drastic measures are required, use tissue that is moistened (not saturated) with methanol. When such cleaning precautions are observed regularly, connectors can maintain their stability for over several thousand connection cycles.

Connectors on the 446A mate non-destructively with military specification MIL-C-39012 Standard Connector Interface. Connectors used to mate with the 446A should also meet this requirement. Failure to do so may result in damage to either connector or inaccurate measurements. Specification gauging is recommended for all connectors prior to configuration hook-up. When *fingered* type-N male connectors are used, ensure that the *fingers* are not collapsed.

Refer to Appendix A for complete information on the care and handling of microwave cables and connectors.

SECTION 6
PERFORMANCE TESTS AND VERIFICATION

6.1 PERFORMANCE TESTS AND VERIFICATION

Performance and verification tests ensure that the Model 446A is operational and performing within design specifications. These procedures can serve as an incoming inspection when the instrument is first received. Thereafter, the tests should be performed every six months or after the repair of a unit as a regular maintenance procedure.

Table 6-1 lists the test equipment required for performance testing and verification of the Model 446A. For each item, the table indicates an acceptable model.

Table 6-1. TEST EQUIPMENT REQUIRED FOR PERFORMANCE TESTS AND VERIFICATION

Equipment	Recommended Model
Power Meter	Hewlett Packard Model 436A
Frequency Counter	Hewlett Packard Model 5342A
Signal Generator Calibrator	W/E Model VM-4A, VM-4B, or VM-24
Spectrum Analyzer	Hewlett Packard Model 8555A
Digital Voltmeter	Fluke Model 8506
50-ohm Power Splitter	W/E Model 1870A
60-dB Attenuator	W/E Model

6.2 PERFORMANCE TESTS

There are three performance tests for the 446A to check 1) that the 446A is furnishing the correct output level, 2) that it is operating at the correct frequency, and 3) that it provides lock simulation data to the VM-4A.

OUTPUT LEVEL

To check that the 446A is operational, connect a power meter to the **1.25 MHz OUTPUT** connector. Check that the **LEVEL ADJUST** knob can be set for an output level of approximately +13 dBm.

FREQUENCY ACCURACY

Connect a frequency counter to one of the rear-panel **10 MHz OUTPUT** connectors. Check that the frequency of this signal is 10 MHz ±10 Hz. Connect the frequency counter to the front-panel **1.25 MHz OUTPUT** connector. Check that this frequency is 1.25 MHz.

VM-4A LOCK SIMULATION

The 446A can provide data to the Model VM-4A to simulate a signal-lock condition. To check the operation of this function, remove the VM-4A interface bus from the lower unit of a VM-4A system and connect it to the 446A's **VM4 INTERFACE** connector. Turn on the 446A, then turn on the VM-4A system. On the front panel of the VM-4A, check that the **LOCKED** LED in the **VM-4A** subsection illuminates.

6.3 VERIFICATION

To verify that the 446A is operating within specifications, it must be checked for RF stability and for spectral purity. Also check the 2.5-volt reference voltage on the 446A for stability.

6.3.1 RF Stability

Use a Weinschel Engineering Model VM-4A, VM-4B, or VM-24 Signal Generator Calibrator to check the RF stability of the Model 446A. RF stability should be checked at a signal level of approximately 0 dBm. With a power meter, set the **LEVEL** control on the 446A for a 0-dBm leveled signal (Figure 6-1).

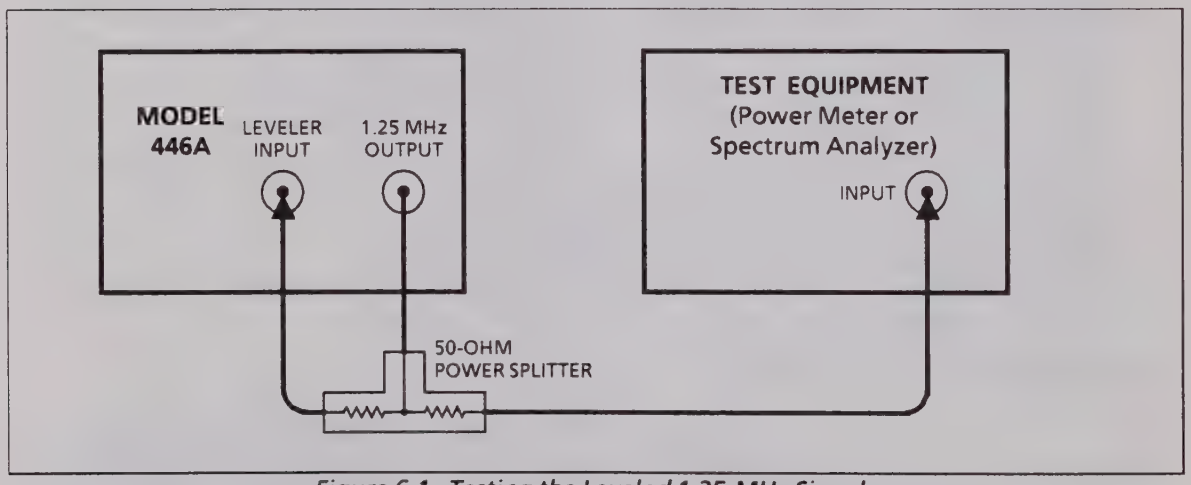


Figure 6-1. Testing the Leveled 1.25-MHz Signal

Figure 6-2 shows the test setup used to check the 446A for RF stability using a VM4A, VM-4B or VM-24. To connect the test setup, connect the leveled 1.25-MHz signal from the 446A to the Channel I IF input on a VM-4A or VM-4B, or to the IF input on a VM-24. Connect this signal through a 60-dB attenuator. Remove the 10-MHz reference signal cable from the lower unit, and connect it to one of the **10 MHZ** outputs on the rear panel of the 446A. If a VM-4A is used, disconnect the VM-4A interface bus from the lower unit and connect it to the rear-panel **VM4 INTERFACE** connector on the 446A (Figure 6-2B).

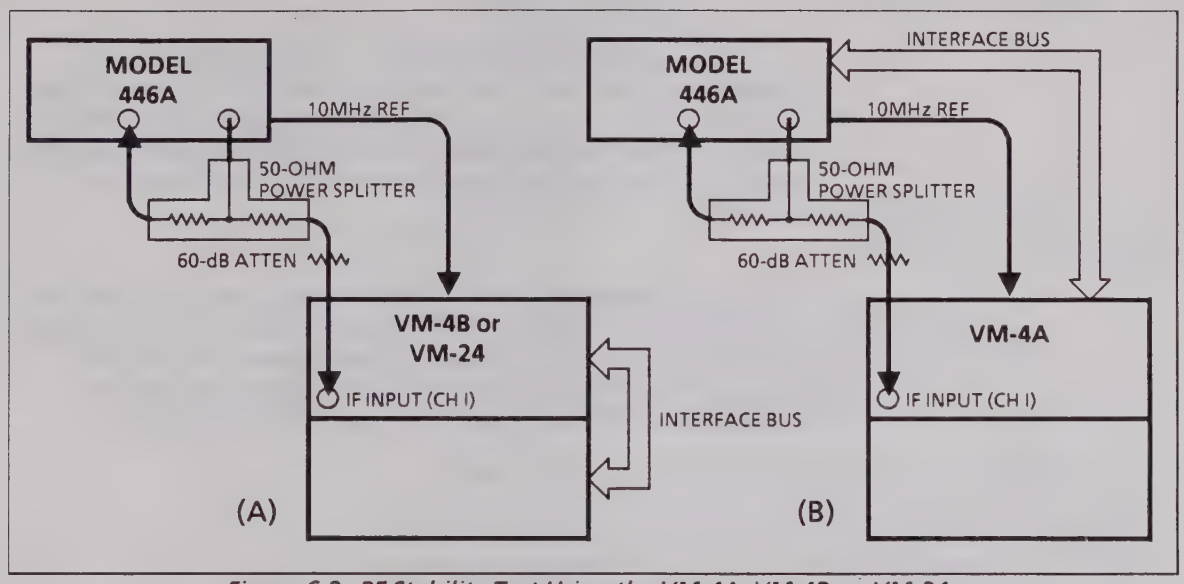


Figure 6-2. RF Stability Test Using the VM-4A, VM-4B, or VM-24

On the VM-4A, connect the test setup shown in Figure 6-2B. To obtain a signal-lock condition, turn on the 446A and then the VM-4A. After a warmup of at least three or four hours, take a reference measurement and then a measurement-minus-reference reading. The reading should not change by more than ±0.002 dB over a period of five minutes.

On the VM-4B, obtain a signal-lock condition (see Paragraph 5A.13 in the *VM-4B Attenuator and Signal Generator Operation and Service Manual, Volume 1*). Then connect the test setup shown in Figure 6-2A, and turn on the 446A. After a warmup of at least three or four hours, take a reference measurement and then a measurement-minus-reference reading. The reading should not change by more than ±0.002 dB over a period of five minutes.

On the VM-24, obtain a signal-lock condition (see Paragraph 5A.16.1 in the *VM-24 Signal Generator Calibrator/Frequency and Power Meter Operation and Service Manual, Volume 2*). Then connect the test setup shown in Figure 6-2A, and turn on the 446A. After a warmup of at least three or four hours, take a reference attenuation measurement, and then take a high-resolution attenuation measurement. The reading should not change by more than ±0.002 dB over a period of five minutes.

6.3.2 Spectral Purity

To check for spectral purity, connect the leveled signal to a spectrum analyzer (Figure 6-1). With a signal level of 0 dBm from the power splitter, check that within ±60 Hz of the fundamental frequency all harmonics are at least 50 dB below the signal level of the fundamental.

6.3.3 2.5-Volt Stability

If the voltage at the **2.5V** terminals is to be used for the purpose for which it is designed, it must be very stable. To verify its stability, connect a voltmeter to the **2.5V** terminals and check that the voltage does not vary by more than ±0.0001 volts over a period of 5 minutes.

SECTION 7
CALIBRATION

7.1 ADJUSTMENTS ON THE MODEL 446A

The following components in the Model 446A are adjustable:

Y1 - 10-MHz crystal oscillator
T1 - transformer for the first tuned RF stage
T2 - transformer for the second tuned RF stage
L1 - feedback coil for the tuned RF stages
R42 - adjustment potentiometer for 2.5-volt reference

These components have been factory adjusted and require no further adjustment unless circuit components are replaced. To gain access to the adjustable components, remove ten screws to remove the 446A's top cover. Use the 446's PC board assembly drawing (Figure 9-2) to locate components on the board; use the schematic diagram (Figure 10-1) to determine how the components are connected.

A frequency counter, an oscilloscope, and a digital voltmeter are needed to calibrate the Model 446A. Recommended models are listed in Table 7-1.

Table 7-1. TEST EQUIPMENT REQUIRED TO CALIBRATE THE MODEL 446A

Equipment	Recommended Model
Frequency Counter	Hewlett Packard Model 5342A
Oscilloscope	Tektronix Model 5440
Digital Voltmeter	Fluke Model 8506
50-ohm Power Splitter	W/E Model 1870A
50-ohm Termination	W/E Model M1404N

Figure 7-1 shows the location of the adjustable components, test points, and jumper blocks found on the 446A's PC board. The six test points, TP1 to TP6, are wire loops on the component side of the PC board that are useful for connecting test equipment to certain points in the circuit.

The two jumper blocks, JB1 and JB2, are used to open circuit loops for test purposes. They are shown in the normal operating position connecting Pins 1 and 2. For JB1, the dotted lines indicate the test position, which connects Pins 1 and 3.

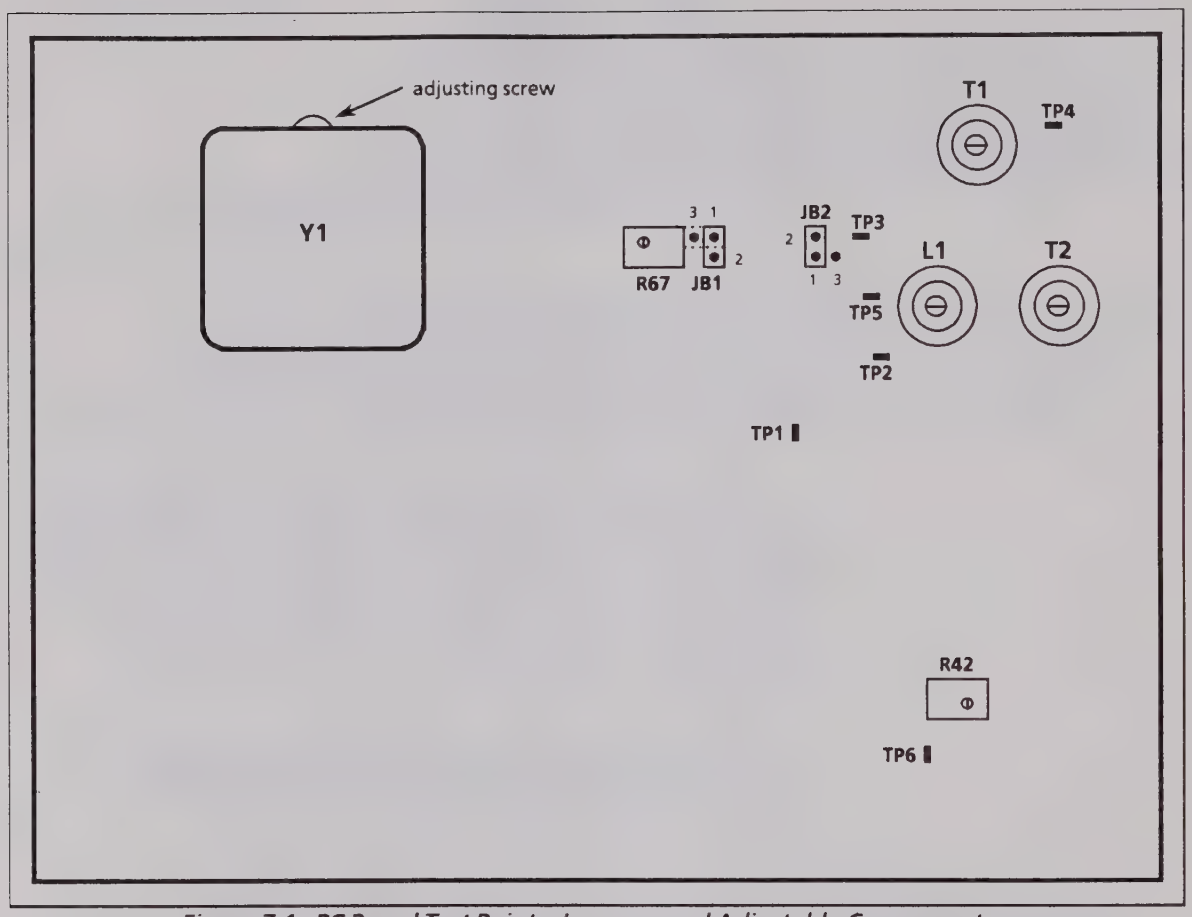


Figure 7-1. PC Board Test Points, Jumpers, and Adjustable Components

7.2 10-MHz CRYSTAL OSCILLATOR Y1

The 10-MHz crystal oscillator Y1 has an adjusting screw that fine tunes its output frequency. After removing the cover of the 446A, adjust Y1 as follows:

A. Connect a frequency counter to one of the rear-panel **10 MHz OUTPUT** connectors.

B. Remove the screw from the side of Y1.

C. Insert a small, non-magnetic screwdriver into the hole in the side of Y1, and set the adjusting screw for a frequency of 10 MHz ±10 Hz.

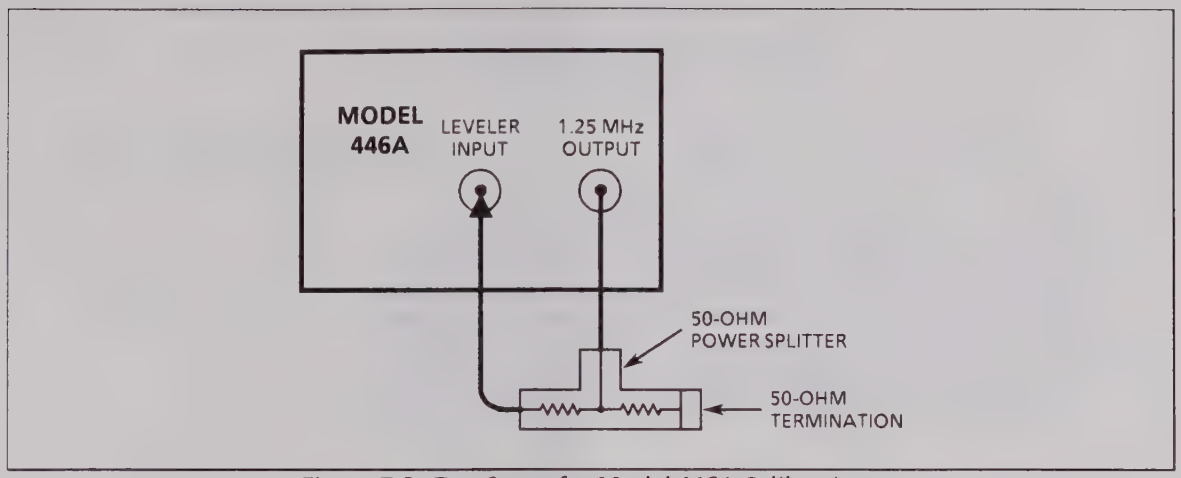


Figure 7-2. Test Setup for Model 446A Calibration

7.3 T1 , T2, AND L1 ADJUSTMENT

To adjust the components T1, T2, and L1, connect the test setup shown in Figure 7-2. The **1.25 MHz OUTPUT** connector connects to a power splitter. One side of the splitter connects to the **LEVELER INPUT** connector, and the other side is terminated with a 50-ohm termination. Use the following method to adjust T1, T2, and L1:

A. Move JB1 to the test position so that it connects Pins 1 and 3. This connects R8 to the wiper of R67 so that R67 can be used to adjust the signal level into the RF amplifier stages.

B. Probe Pin 1 connected to JB1 with a voltmeter, and adjust R67 for +7.0 volts at Pin 1.

C. Remove JB2 to eliminate the feedback circuit from the tuned RF amplifier stages.

D. Connect the Channel 1 and Channel 2 probes of an oscilloscope to TP3 and TP4. Turn the adjusting screw of T2 all the way clockwise, and adjust T1 for maximum signal at TP4. The square wave at TP3 and the sine wave at TP4 should be out of phase (approximately 190°).

E. Connect the oscilloscope probes to TP4 and TP5. Adjust T2 for maximum undistorted signal at TP5. The sine wave at TP4 must also be undistorted, and it must lead, not lag, the sine wave at TP5 (see Figure 7-3).

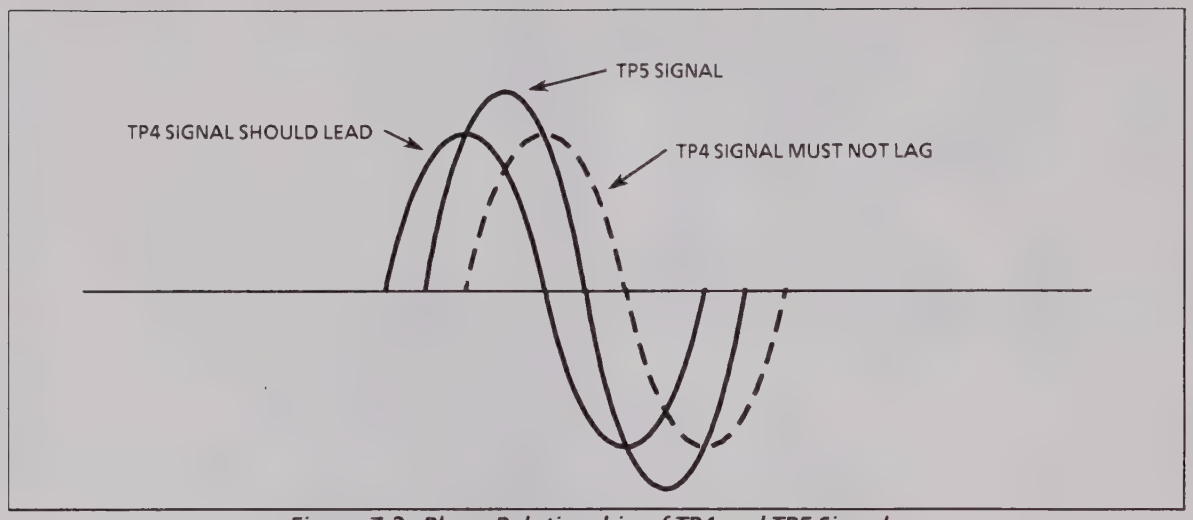


Figure 7-3. Phase Relationship of TP4 and TP5 Signal

F. Reconnect JB2 and adjust L1 for maximum signal at TP5.

G. Return JB1 to the normal operating position to connect Pins 1 and 2 and activate the leveling loop.

H. Connect a voltmeter to TP1, and adjust the front-panel **LEVEL** control R1 for +10 volts dc at TP1.

I. Adjust T1 for a minimum voltage at TP1. If the signal at TP5 is amplitude modulated, adjust L1 clockwise until the modulation stops.

J. While adjusting the **LEVEL** control through its entire range, check the signal at TP5 to make sure that it does not oscillate. If oscillation occurs, adjust L1 clockwise until the oscillation stops. When the **LEVEL** control is at maximum, the voltage at TP1 should be approximately +6.5 to +7 volts.

7.4 2.5-V0LT REFERENCE ADJUSTMENT

Connect a digital voltmeter to the front-panel **2.5V** terminals. Adjust R42 for a reading of 2.500 volts dc ±0.001 V.

SECTION 8
TROUBLESHOOTING

8.1 INTRODUCTION

The circuitry for the Model 446A is contained on a single PC board. If a failure occurs, the 446A must either be returned to Weinschel Engineering for repairs or component-level repairs must be done. Replacement of components on the PC board voids the one-year warranty of the Model 446A. Refer to Paragraph 5.2 for information on returning the 446A to Weinschel Engineering for repairs.

Paragraph 8.2 describes a checkout procedure that is useful for localizing component failures on the 446A. Figure 8-1 shows the location of test points TP1 to TP6, jumper blocks JB1 and JB2, and selected components and pin numbers on the PC board. For additional information, use the assembly drawing of the PC board (Figure 9-2) and the schematic diagram (Figure 10-1).

8.2 MODEL 446A CHECKOUT

The steps listed below describe a checkout procedure for the 446A. The procedure requires a digital voltmeter for voltage checks and an oscilloscope to check signal levels. The common lead of the test equipment may be grounded to the chasis of the 446A. Remove the cover of the Model 446A and connect the 446A as shown in Figure 7-2. Perform the steps listed below. Also refer to the 446A calibration procedure given in Paragraph 7.3.

A. Check for −15 and +15 volts ±0.4 volts at Pins 4 and 7 of U3. Check for +5 volts ±0.2 volts at Pin 20 of U11. If any of these voltages is incorrect, a power supply failure is indicated.

B. Check for a 10-MHz TTL square wave at Pins 3 and 11 of U11. If the square wave is incorrect, check for a failure of Y1 or U11.

C. Check for a 1.25-MHz TTL square wave at Pin 11 of U5. An incorrect signal indicates a failure of U5.

D. Move JB1 to the test position so that it connects Pins 1 and 3, and adjust R67 for +7.00 volts at Pin 1. Remove JB2 and check for a negative 2.75 Vpp

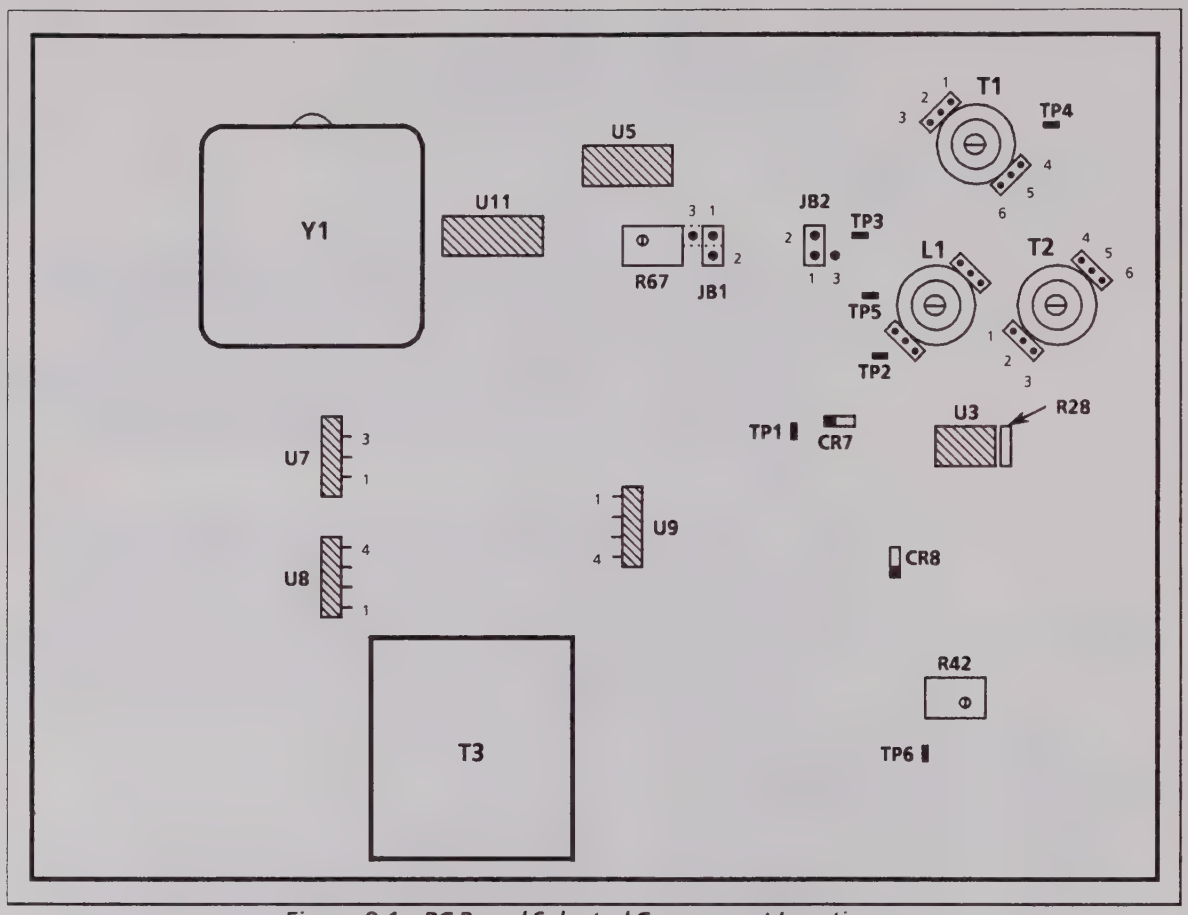


Figure 8-1. PC Board Selected Component Locations

square wave at TP3. If this signal is not correct, a probable failure of U6 is indicated.

E. Check for a sine wave at TP4. When T1 is adjusted for maximum signal at TP4, the typical signal level is 6.5 to 7.0 Vpp. When T1 is correctly wound, the signal at TP4 is approximately 190° out of phase with the square wave at TP3. A failure at TP4 indicates that transistors Q3, Q4, and Q5 should be checked.

F. Check for a sine wave at TP5. When T2 is adjusted for maximum undistorted signal at TP5 and TP4, the signal level at TP5 is typically 10 Vpp. When T2 is adjusted correctly, the signal at TP4 leads the signal at TP5 as shown in Figure 7-3. An incorrect signal at TP5 indicates that transistors Q1 and Q2 should be checked.

G. Reconnect JB2. When L1 is adjusted for maximum output at TP5, the signal level at TP5 is typically 4.2 to 4.8 Vpp.

H. Check for a 1.25-MHz signal into R28 (at the spot shown in Figure 8-1). If this signal is not present, check the RF connections to the front-panel **LEVELER INPUT** connector.

I. Check the dc voltage at the cathode of CR7. This voltage should be approximately +0.40 to +0.50 volts. If it is not correct, check U3 and CR7.

J. Check the dc voltage at the anode of CR8. You should be able to vary this voltage over a range of 0 to −6.5 volts with the front-panel **LEVEL** control R1. If this voltage is incorrect, check U4, CR8, and CR10.

K. Adjust R67 for minimum voltage at Pin 1 connected to JB1. With the **LEVEL** control at maximum, check the voltage at TP1. This voltage should be between +11.5 and +12.5 volts. Turn the **LEVEL** control to minimum. The voltage at TP1 should go to zero. If the voltage at TP1 is not correct, check U2, CR5, and CR6.

L. Check for the correct voltage at the front-panel **2.5V** terminals. The voltage at TP6 should be between −6.6 and −7.3 volts as determined by CR2.

M. To restore the circuit for normal operation, reconnect JB1 to pins 1 and 2.

SECTION 9
REPLACEABLE PARTS

9.1 INTRODUCTION

This section provides information on locating the assemblies and replaceable parts on the Model 446A. It also provides information on ordering replacement parts. Paragraph 9.4 lists the drawings and parts lists included in this manual for parts-identification purposes.

9.2 UNDERSTANDING REFERENCE DESIGNATORS

All subassemblies and electrical parts are identified by standard reference designators (resistor R1, for example). Reference designators are used in parts lists and on parts-identification drawings. The title of a parts list or drawing contains the reference designator of the assembly or subassembly to which it applies. The designator in the title of a parts list belongs to all the designators in the parts list, as a prefix, but is omitted from the list to make it easier to locate a specific part. To complete a reference designator in a parts list, precede the designator for the specific part (DS1, for example) with the designator in the title (A6, for example) to form a complete reference designator for the part (in this case, A6DS1).

In addition to the electrical parts that are normally listed, some mechanical parts are also listed. These lack reference designators and are included because they are considered subject to wear or breakage, or because they are custom (non-standard) hardware or parts that might become lost or damaged. They are identified by their Weinschel part numbers and, where they appear on a parts-identification drawing, by item numbers.

9.3 ORDERING INFORMATION FOR REPLACEMENT PARTS

When ordering replacement assemblies, subassemblies, or parts, include the following information:

A. the Weinschel Engineering Part Number,

B. a description of the part,

C. the model number and serial number of the instrument, and

D. the assembly number and assembly revision (if any) from the assembly (on the component side of the P.C. boards).

9.4 LOCATING PARTS LISTS AND DRAWINGS

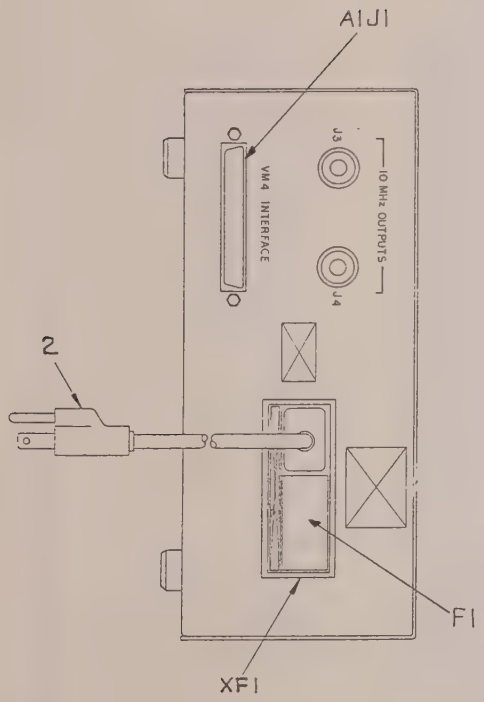
Every assembly on the Model 446A has one or more component-location drawings associated with it. This manual provides a drawing and a parts list for the major assemblies of the 446A. Table 9-1 lists the drawings and parts lists included in the manual for parts-identification purposes and gives the figure number or table number for each.

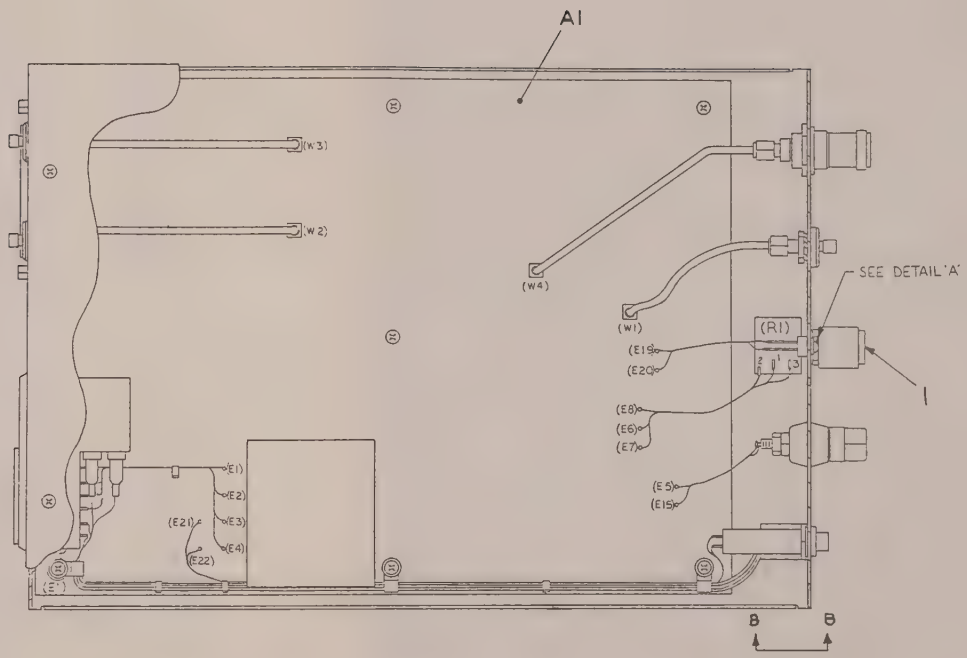
Table 9-1. MODEL 446A DRAWINGS AND PARTS LISTS

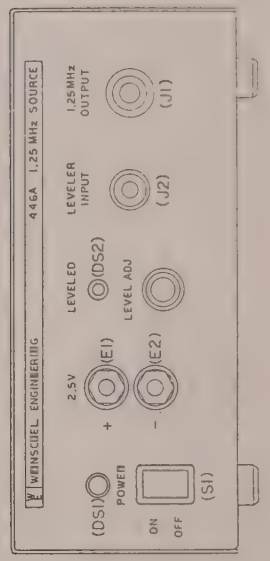
Assembly	Drawing	Parts List
Unit Assembly	Figure 9-1	Table 9-2
PC Board Assembly (A1)	Figure 9-2	Table 9-3

TABLE 9-2. ASSY., 1.25 MHZ SOURCE 446A, 183-300, REV. A

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
A1	ASSY PCB 1.25 MHZ SOURCE	183-310-000		93459
DS1	PILOT LIGHT RED NEON 100K RES	051-34	249-7841-1431-574	96312
DS2	LED GREEN WITH BLACK HOLDER	012-288	HLMP 3507	28480
E1	CONN BINDING POST RED	062-19-2	257-102	83330
E2	CONN BINDING POST BLACK	062-19-1	257-103	83330
F1	FUSE 1 AMP	052-1-1	312001	71400
F2	FUSE 1/2 AMP	052-1-1/2	312.500	71400
J1	ASSY ADAPTER 3MM F TO N FEMALE	136-183		93459
J2	WPM 3 BULKHEAD ADAPTER	1568		93459
J3	WPM 3 BULKHEAD ADAPTER	1568		93459
J4	WPM 3 BULKHEAD ADAPTER	1568		93459
R1	POT WW 10 TURN 20K 3%	020-182	534-203	16556
S1	SWITCH DPDT BLACK ON/OFF	055-97	XRM-210N-00	91506
XF1	FUSE HOLDER AND POWER INPUT	051-28	6J4	05245
1	KNOB BLACK ROUND SPUN ALUM	071-56	DSN-70-2	21604
2	CORD POWER 10A-125V	068-21	17250	16428

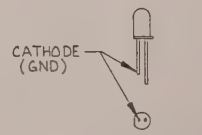






WIRE CHART

FROM	TO	LENGTH	COLOR	ITEM	REMARKS
XF1-L	S1-2		BLK	50	TWISTED PAIR
XF1-N	S1-5		WHT	51	
XF1-B	S1-1		GRY	52	TWISTED PAIR
XF1-J	S1-4		WHT	51	
XF1-CASE	E1		YEL/GRN	55	
XF1-C	A1-E1		WHT/BRN	56	
XF1-D	A1-E3		WHT/RED	57	
XF1-E	A1-E2		WHT/ORG	58	
XF1-F	A1-E4		WHT/YEL	59	
XF1-A	——	—	—	—	
1DS2 (ANODE)	A1-E19		RED	53	TWISTED PAIR SEE DETAIL 'A'
1DS2 (CATHODE)	A1-E20		BLK	50	
1R1-2	A1-E6		WHT/BLU	60	TWISTED
1R1-3	A1-E7		VIO	54	
1R1-1	A1-E8		BLK	50	
1E1	A1-E5		WHT/GRN	49	TWISTED PAIR
1E2	A1-E15		BLK	50	
1DS1-+	A1-E21		WHT/RED	57	TWISTED PAIR
1DS1-B	A1-E22		WHT/YEL	59	
1J1	A1W4-P1	—	—	—	
1J2	A1W1-P1	—	—	—	
1J3	A1W3-P1	—	—	—	
1J4	A1W2-P1	—	—	—	



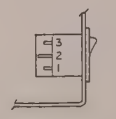


Figure 9-1
1.25 MHz Source Assy., 183-300, Rev A

TABLE 9-3. ASSY., PC BD., 1.25 MHZ SOURCE, 183-310-000, REV. A

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
C1	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289
C2	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289
C3	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289
C4	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289
C5	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289
C6	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289
C7	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C8	CAP CER .22UF 50V 10%	034-28-224	CK06BX224K	56289
C9	CAP MICA 560PF 100V 5%	034-29-561	CD7FA561J03	88124
C10	CAP CER 470000PF 50V 10%	034-28-474	CK06BX474K	56289
C11	CAP MICA 470PF 100V 5%	034-29-471	CD7FA471J03	88124
C12	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C13	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C14	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C15	CAP MICA 560PF 100V 5%	034-29-561	CD7FA561J03	88124
C16	CAP MICA 560PF 100V 5%	034-29-561	CD7FA561J03	88124
C17	CAP CER 1000PF 200V 10%	034-27-102	CK05BX102K	56289
C18	CAP MICA 6PF 500V .5PF	034-29-060	CD6CD060D03	88124
C19	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C20	CAP CER 470000PF 50V 10%	034-28-474	CK06BX474K	56289
C21	CAP CER 470000PF 50V 10%	034-28-474	CK06BX474K	56289
C22	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C23	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C24	CAP CER 22000PF 50V 10%	034-27-223	CK05BX223K	56289
C25	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C26	CAP TANT 2.2UF 20V 10%	031-111-225	T368A225K020AS	05397
C27	CAP ELEC 500UF 35V	031-99	TVA 1227	56289
C28	CAP ELEC 500UF 35V	031-99	TVA 1227	56289
C29	CAP CER 330000PF 50V 10%	034-28-334	CK06BX334K	56289
C30	CAP CER 1UF 50V 10%	034-28-105	CK06BX105K	56289
C31	CAP TANT 100.0UF 20V 10%	031-111-107	T368D107K020AS	05397
C32	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C33	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C34	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C35	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C36	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C37	CAP CER 1000PF 200V 10%	034-27-102	CK05BX102K	56289
C38	CAP MICA 560PF 100V 5%	034-29-561	CD7FA561J03	88124
C39	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
C40	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289
CR1	NOT USED			
CR2	DIODE 6.95 V	012-439	LM399AH	12040
CR3	DIODE ZENER	012-50	1N751A	81349
CR4	DIODE GENERAL PURPOSE	012-51	1N3064	81349
CR5	DIODE GENERAL PURPOSE	012-51	1N3064	81349
CR6	DIODE GENERAL PURPOSE	012-51	1N3064	81349
CR7	DIODE SCHOTTKY BARRIER	012-396	5082-2804	28480
CR8	DIODE SCHOTTKY BARRIER	012-396	5082-2804	28480
CR9	BRIDGE RECTIFIER 100V 1.5A	012-313	MDA100	04713
CR10	DIODE ZENER PRECISION 6.9V	012-391	LM129AH	12040
DS1	LED GREEN	012-349	5082-4190	28480
E1	TERMINAL STANDOFF	074-474	4531B-5.04	15849
E2	TERMINAL STANDOFF	074-474	4531B-5.04	15849
E3	TERMINAL STANDOFF	074-474	4531B-5.04	15849
E4	TERMINAL STANDOFF	074-474	4531B-5.04	15849
E5	TERMINAL STANDOFF	074-474	4531B-5.04	15849
E6	TERMINAL STANDOFF	074-474	4531B-5.04	15849
E7	TERMINAL STANDOFF	074-474	4531B-5.04	15849
E8	TERMINAL STANDOFF	074-474	4531B-5.04	15849

TABLE 9-3. ASSY., PC BD., 1.25 MHZ SOURCE, 183-310-000, REV. A

-CONTINUED-

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
E15	TERMINAL STANDOFF	074-474	4531B-5.04	15849
E19	TERMINAL STANDOFF	074-474	4531B-5.04	15849
E20	TERMINAL STANDOFF	074-474	4531B-5.04	15849
E21	TERMINAL STANDOFF	074-474	4531B-5.04	15849
E22	TERMINAL STANDOFF	074-474	4531B-5.04	15849
J1	CONN RT ANGLE 37 PIN	062-317	H3R37RA28A	00000
L1	INDUCTOR	190-241		93459
L2	INDUCTOR	190-398		93459
L3	INDUCTOR	190-398		93459
L4	INDUCTOR	190-398		93459
Q1	TRANSISTOR SELECTED	190-284-2		93459
Q2	TRANSISTOR SELECTED	190-284-1		93459
Q3	TRANSISTOR NPN	012-337	2N5179	86684
Q4	TRANSISTOR NPN	012-337	2N5179	86684
Q5	TRANSISTOR NPN	012-291	2N2222A	81349
R1	RES METALFILM 196 1/4W 1%	025-33-1960	C4196R 1%	14674
R2	RES METALFILM 100 1/4W 1%	025-33-1000	C4100R 1%	14674
R3	RES METALFILM 68.1K 1/4W 1%	025-33-6812	C468.1K 1%	14674
R4	RES METALFILM 196K 1/4W 1%	025-33-1963	C4196K 1%	14674
R5	RES METALFILM 100 1/4W 1%	025-33-1000	C4100R 1%	14674
R6	RES METALFILM 21.5K 1/4W 1%	025-33-2152	C421.5K 1%	14674
R7	RES METALFILM 100 1/4W 1%	025-33-1000	C4100R 1%	14674
R8	RES METALFILM 100 1/4W 1%	025-33-1000	C4100R 1%	14674
R9	RES METALFILM 3160 1/4W 1%	025-33-3161	C43.16K 1%	14674
R10	RES METALFILM 4220 1/4W 1%	025-33-4221	C44.22K 1%	14674
R11	RES METALFILM 1K 1/4W 1%	025-33-1001	C41K 1%	14674
R12	RES METALFILM 100 1/4W 1%	025-33-1000	C4100R 1%	14674
R13	RES METALFILM 6190 1/4W 1%	025-33-6191	C46.19K 1%	14674
R14	RES METALFILM 1470 1/4W 1%	025-33-1471	C41.47K 1%	14674
R15	RES METALFILM 51.1K 1/4W 1%	025-33-5112	C451.1K 1%	14674
R16	RES METALFILM 1330 1/4W 1%	025-33-1331	C41.33K 1%	14674
R17	RES METALFILM 13.3K 1/4W 1%	025-33-1332	C413.3K 1%	14674
R18	RES METALFILM 1960 1/4W 1%	025-33-1961	C41.96K 1%	14674
R19	RES METALFILM 121 1/4W 1%	025-33-1210	C4121R 1%	14674
R20	RES METALFILM 4640 1/4W 1%	025-33-4641	C44.64K 1%	14674
R21	RES METALFILM 2870 1/4W 1%	025-33-2871	C42.87K 1%	14674
R22	RES METALFILM 10 1/4W 1%	025-33-10R0	C410R 1%	14674
R23	RES METALFILM 562 1/4W 1%	025-33-5620	C4562R 1%	14674
R24	RES METALFILM 422 1/4W 1%	025-33-4220	C4422R 1%	14674
R25	RES METALFILM 4220 1/4W 1%	025-33-4221	C44.22K 1%	14674
R26	RESISTOR PRECISION	190-189-13		93459
R27	RESISTOR PRECISION	190-189-13		93459
R28	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R29	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R30	RES METALFILM 3740 1/4W 1%	025-33-3741	C43.74K 1%	14674
R31	RES METALFILM 1K 1/4W 1%	025-33-1001	C41K 1%	14674
R32	RES METALFILM 1K 1/4W 1%	025-33-1001	C41K 1%	14674
R33	RES METALFILM 909 1/4W 1%	025-33-9090	C4909R 1%	14674
R34	RES METALFILM 909 1/4W 1%	025-33-9090	C4909R 1%	14674
R35	RES METALFILM 17.8K 1/4W 1%	025-33-1782	C417.8K 1%	14674
R36	RES METALFILM 61.9K 1/4W 1%	025-33-6192	C461.9K 1%	14674
R37	RES METALFILM 31.6K 1/4W 1%	025-33-3162	C431.6K 1%	14674
R38	RES METALFILM 14.7K 1/4W 1%	025-33-1472	C414.7K 1%	14674
R39	NOT USED			
R40	RES FILM 499 1% 1/4W	025-33-4990	C449R 1%	14674
R41	RESISTOR FILM 10K 1%	025-39-2	S102K	18612
R42	POT 1K 10% 10 PPM	020-219-1001	S102K	18612
R43	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R44	RES FILM 3.32K 1% 1/4W 25PPM	025-40-3321	CMF55-3.32K 1% T-9	91637
R45	RES FILM 2.55K 1% 1/4W	025-33-2551	C425.5K 1%	14674
R46	RES FILM 2.55K 1% 1/4W	025-33-2551	C425.5K 1%	14674

TABLE 9-3. ASSY., PC BD., 1.25 MHZ SOURCE, 183-310-000, REV. A

-CONTINUED-

REF. DES.	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	MFG. CODE
R47	RES FILM 2.55K 1% 1/4W	025-33-2551	C425.5K 1%	14674
R48	RES WW 75 5W 5%	026-6-75	RS-5-75-5	91637
R49	RES METALFILM 20K 1/4W 1%	025-33-2002	C420K 1%	14674
R50	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R51	RES WW 1 5W 5%	026-6-1	RS-5-1-5	91637
R52	RES WW 1 5W 5%	026-6-1	RS-5-1-5	91637
R53	RES METALFILM 9090 1/4W 1%	025-33-9091	C49.09K 1%	14674
R54	RES METALFILM 6810 1/4W 1%	025-33-6811	C46.81K 1%	14674
R55	RES METALFILM 12.1K 1/4W 1%	025-33-1212	C412.1K 1%	14674
R56	RES METALFILM 261 1/4W 1%	025-33-2610	C4261R 1%	14674
R57	RES METALFILM 196 1/4W 1%	025-33-1960	C4196R 1%	14674
R58	RES METALFILM 196 1/4W 1%	025-33-1960	C4196R 1%	14674
R59	RES METALFILM 196 1/4W 1%	025-33-1960	C4196R 1%	14674
R60	RES METALFILM 196 1/4W 1%	025-33-1960	C4196R 1%	14674
R61	RES METALFILM 196 1/4W 1%	025-33-1960	C4196R 1%	14674
R62	RES METALFILM 196 1/4W 1%	025-33-1960	C4196R 1%	14674
R63	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R64	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R65	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R66	RES METALFILM 10K 1/4W 1%	025-33-1002	C410K 1%	14674
R67	POT RES VAR 2K 10%	020-210-202	860W 2K	10625
T1	TRANSFORMER	190-242		93459
T2	TRANSFORMER	190-243		93459
T3	TRANSFORMER	040-201	14A-20-36	08779
TP1	TEST POINT	074-820	TP-101-10	26364
TP2	TEST POINT	074-820	TP-101-10	26364
TP3	TEST POINT	074-820	TP-101-10	26364
TP4	TEST POINT	074-820	TP-101-10	26364
TP5	TEST POINT	074-820	TP-101-10	26364
TP6	TEST POINT	074-820	TP-101-10	26364
U1	IC VOLTAGE COMPARATOR/BUFFER	015-07-LM319	LM319H	12040
U2	IC OP AMP 8 PIN	012-267	OP-05CJ	06665
U3	IC OP AMP	015-07-LM318	LM318N	12040
U4	IC OP AMP	015-07-07	OP07EJ	06665
U5	IC 4 BIT BINARY COUNTER	015-10-93	SN74LS93N	01295
U6	IC TRANSISTOR ARRAY NPN	015-09-3146	CA3146AE	86684
U7	IC REGULATOR +5 VOLT	015-07-78M05	UA78M05UC	82170
U8	IC VOLTAGE REGULATOR POSITIVE	015-07-78MGU1	UA78MGUIC	82170
U9	IC VOLTAGE REGULATOR NEGATIVE	015-07-79MGU1	UA79MGUIC	82170
U10	IC OP AMP	015-07-07	OP07EJ	06665
U11	IC OCTAL BUFFERS TRI-STATE	015-10-244	SN74LS244N-00	01295
U12	IC QUAD 2-INPUT NAND GATE	015-10-00	SN74LS00N-00	01295
U13	IC OCTAL D TYPE FLIP FLOP	015-10-374	SN74LS374N-00	01295
U14	IC OCTAL D TYPE FLIP FLOP	015-10-374	SN74LS374N-00	01295
W1	ASSY CABLE	183-311-1		93459
W2	ASSY CABLE	183-311-2		93459
W3	ASSY CABLE	183-311-3		93459
W4	ASSY CABLE TYPE N CONN	183-312		93459
Y1	OSC CRYSTAL 10 MHZ	016-129	252-3971	21962
1	HEATSINK STANDUP	074-826	6230B-TT	31303
2	INSULATOR TO-220	012-29-6	60-11-8302-1674	18565

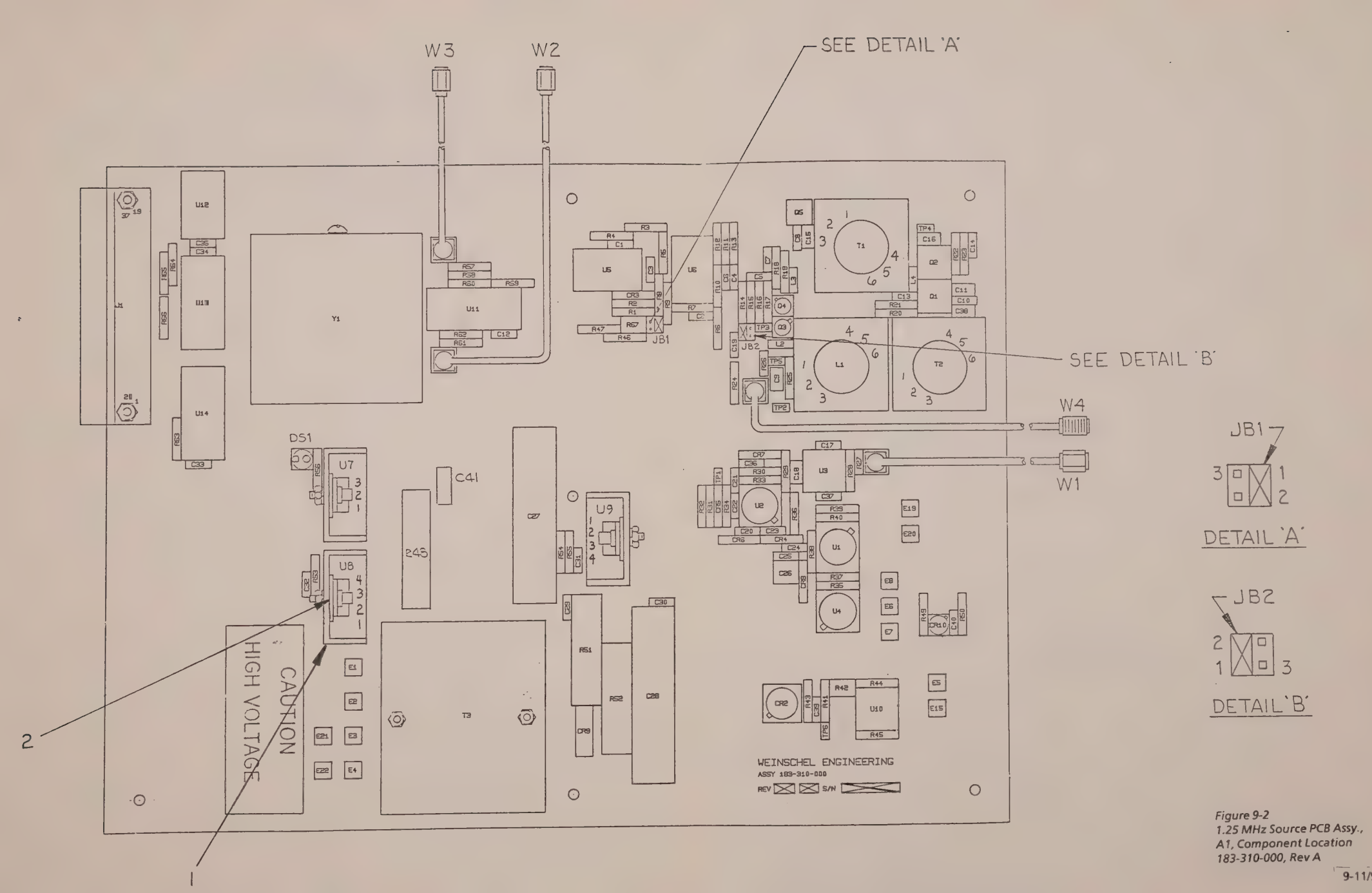
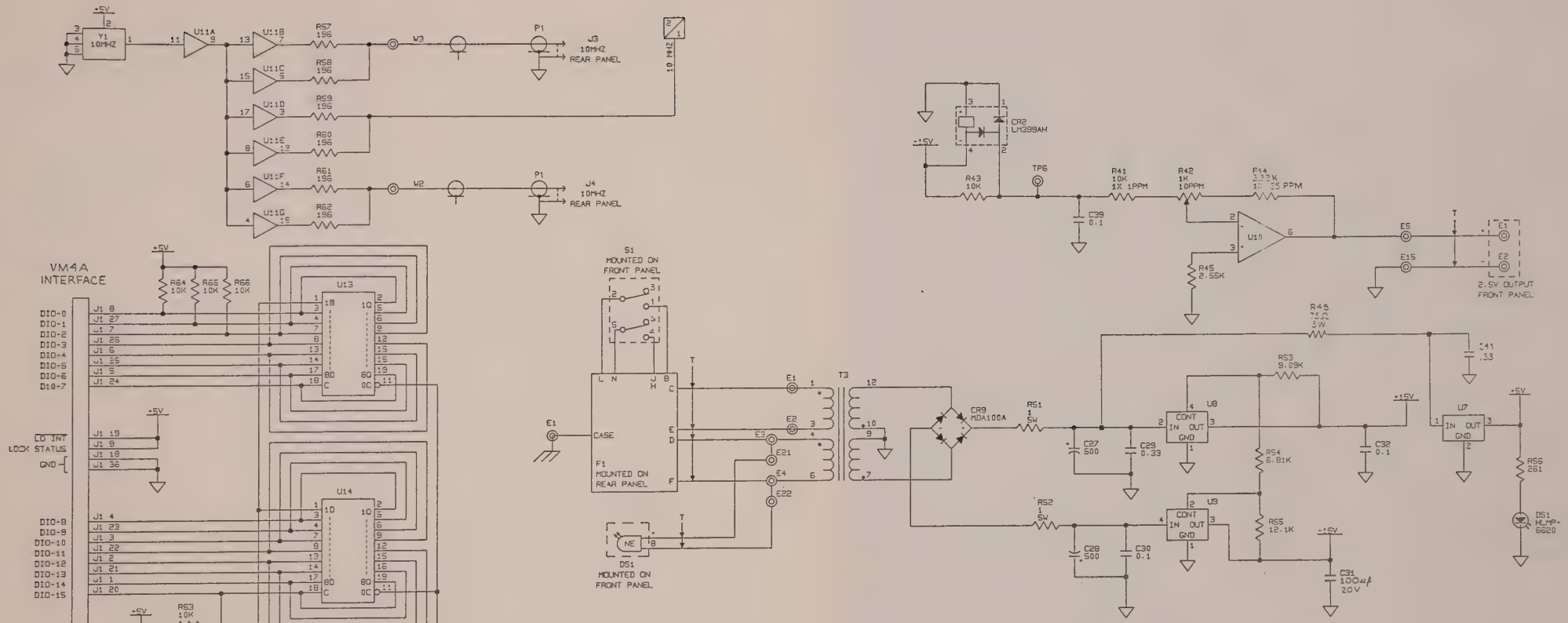


Figure 9-2
1.25 MHz Source PCB Assy., A1, Component Location 183-310-000, Rev A

SECTION 10
SCHEMATIC DIAGRAMS

10.1 MODEL 446A SCHEMATIC DIAGRAM

The circuitry of the Model 446A is contained on a single PC board. Figure 10-1, Sheets 1 and 2, contain the schematic diagram for the Model 446A.



NOTES:
1. UNLESS OTHERWISE SPECIFIED;
   ALL RESISTORS ARE IN OHMS, .25W, 1%.
   ALL CAPACITORS ARE IN MICROFARADS.
   ALL BYPASS CAPACITORS ARE 0.1 MICROFARAD, 50V, 10%.
   ALL INDUCTORS ARE IN MICROHENRIES.

REF DES	TYPE	+5V		GND	+15V		-15V	
U1	LM319H	10	–	7,5,2	–	–	–	–
U2	OP-05CJ	–	–	–	7	C20*	4	C21*
		–	–	–	–	C93*	4	C22*
U3	LM318N	–	–	–	7	C17*	4	C37*
U4	OP-07EJ	–	–	–	7	–	4	–
U5	SN74LS93N	–	–	10	–	–	–	–
U6	CA3140AE	–	–	–	–	–	–	–
U7	UA78M05UC	–	–	–	–	–	–	–
U8	UA78MGUIC	–	–	–	–	–	–	–
U9	UA79MGUIC	–	–	–	–	–	–	–
U10	OP-07EJ	–	–	–	7	–	4	–
U11	SN74LS244N	20	C12	10	–	–	–	–
		–	–	1,19	–	–	–	–
U12	SN74LS00N	14	C35	7	–	–	–	–
U13	SN74LS374N	20	C34	10	–	–	–	–
U14	SN74LS374N	20	C33	10	–	–	–	–

* THESE CAPACITORS ARE 0.001 MICROFARAD.
‡ THESE CAPACITORS ARE 0.47 MICROFARAD.

SYM	LAST USED	NOT USED
C	C41	–
CR	CR10	CR1
DS	DS1	–
E	E22	E9 - E14, E16 - E18
J	J1	–
JB	JB2	–
L	L4	–
Q	Q5	–
R	R67	R39
T	T3	–
TP	TP6	–
U	U14	–
Y	Y1	–

Figure 10-1
1.25 MHz Source PCB Assy., A1, Schematic Diagram
183-310-200, Rev A, Sheet 1

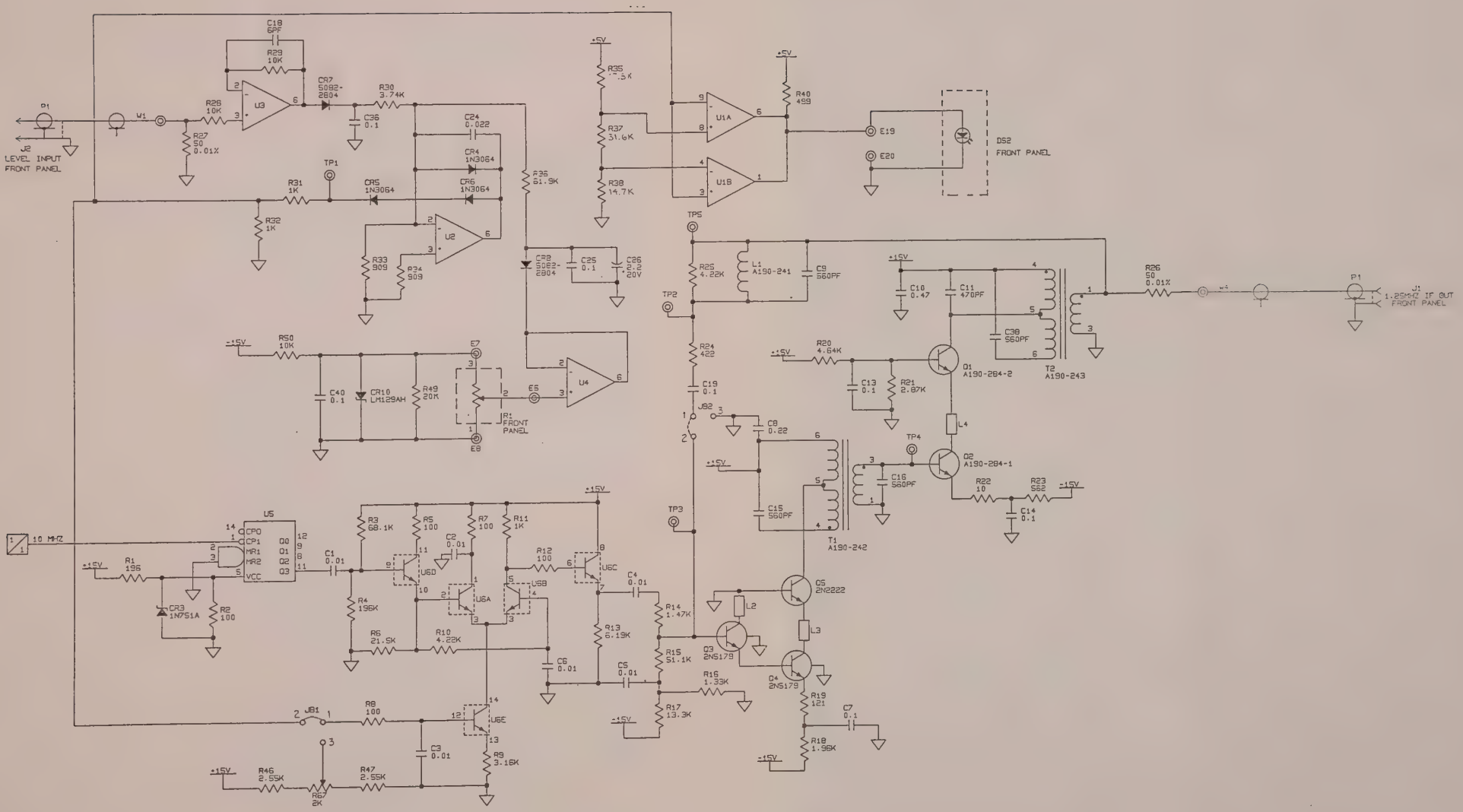


Figure 10-1
1.25 MHz Source PCB Assy.,
A1, Schematic Diagram
183-310-200, Rev A, Sheet 2

APPENDIX A
CARE AND HANDLING OF MICROWAVE COAXIAL CABLE ASSEMBLIES

A-1. CARE AND HANDLING OF ASSEMBLIES

To ensure accurate measurements and optimal performance of Weinschel Engineering products, the microwave coaxial cable assemblies used in system and test setups must be properly used and maintained. Proper connections, routine inspection of all cables, and cleaning of the connectors are extremely important procedures which can prolong the longevity and accuracy of equipment.

A-2. CABLE INSPECTION

Routinely check external cables for signs of cracked insulation, dents, twists, flattening, signs of jacket abrasion, or other signs of abuse. Wrinkles in the jacket indicate that the minimum bend radius has been exceeded. Most often, this occurs near the marker tubes and connectors.

Also inspect the connector interfaces for the following:

- Bent pins (male)
- Bent or missing tines (female)
- Worn or chipped plating
- Damaged or displaced dielectric inserts
- Thread damage
- Folded or mushroomed outer interface rims
- Mushroomed pin shoulders (male) or tine ends (female)
- Score lines on pins and outer interface rims visible to the unaided eye
- Recessed or protruding pins

It is advisable to clean the connectors prior to inspection to make subtle damage more apparent. If any of the above is noted, replace the assembly before its further use results in equipment damage. Also inspect the mating connectors for similar damage.

Table A-1 provides both Weinschel Engineering specifications and MIL-C-39012C data for the pin height of the various types of connectors. Pin height is defined as the vectorial distance along a horizontal axis of the pin shoulder from the electrical/mechanical reference plane.

Table A-1. Pin Height Specifications

CONNECTOR TYPE	W/E SPECIFICATION [1]			MIL-C-39012C
	MALE	FEMALE	SEXLESS	
7 mm	N/A	N/A	0.000 + .000 − .002[2]	See Figure A-1
N type	0.208 min	0.207 max	N/A	See Figure A-2
SMA	0.000 + .000 − .010	0.000 + .000 − .030	N/A	See Figure A-3
WPM	0.000 + .000 − .010	0.000 + .000 − .010	N/A	See Figure A-3
WPM-3	0.000 + .000 − .005	0.000 + .000 − .005	N/A	See Figure A-3
WPM-4	0.000 + .000 − .005	0.000 + .000 − .005	N/A	See Figure A-3
BNC	+.210-+.230	+.186-+.206	N/A	See Figure A-4
TNC	+.210-+.230	+.186-+.206	N/A	See Figure A-5

1 Instances of WE non-compliance to MIL-C-39012C realizes improved VSWR. In all cases WE mates with MIL-C-39012C non-destructively.

2 Complies with IEEE Standard 287

Inspect the connector interface for signs of debris. Debris may be in the form of:

- Plating chips or other metal particles
- Dust or dirt
- Oily films
- Other miscellaneous foreign particles

If signs of debris are present, clean the connector interface as directed in Paragraph A-6.

A-3. MAKING INITIAL CONNECTIONS

Exercise caution when mating cables. Poor connections lead to poor system performance. They can also damage not only the cable assembly, but more significantly, front or rear panel connectors on the equipment itself which may be more difficult to repair.

ALIGNING CONNECTORS

Align the center lines of the connectors before actual mating. Male retaining nuts contain a small amount of necessary play which may make it possible to mate the threads without the pins being properly aligned. Pin misalignment can damage pins and the entire assembly.

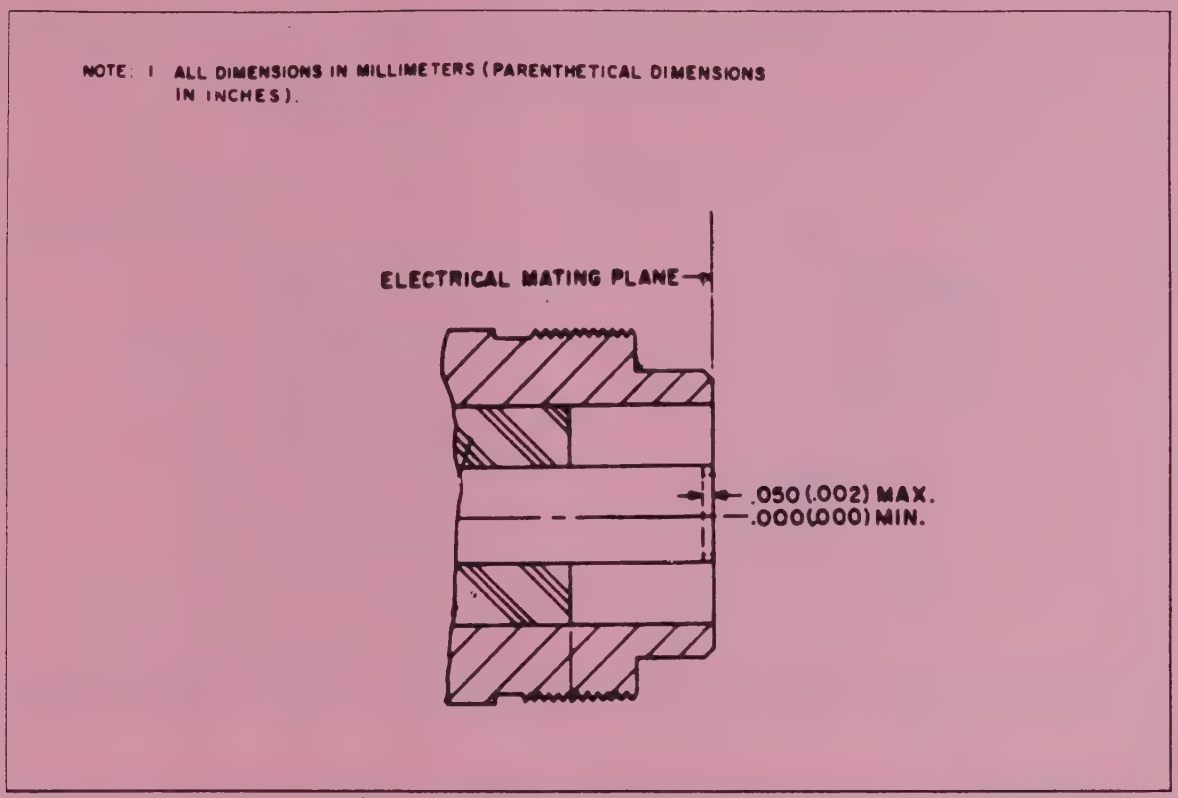

NOTE: 1 ALL DIMENSIONS IN MILLIMETERS (PARENTHETICAL DIMENSIONS IN INCHES).
ELECTRICAL MATING PLANE
.050 (.002) MAX.
.000 (.000) MIN.

Figure A-1. Important Interface Dimensions for Type 7 MM, Precision Connectors (IEEE Std 287)

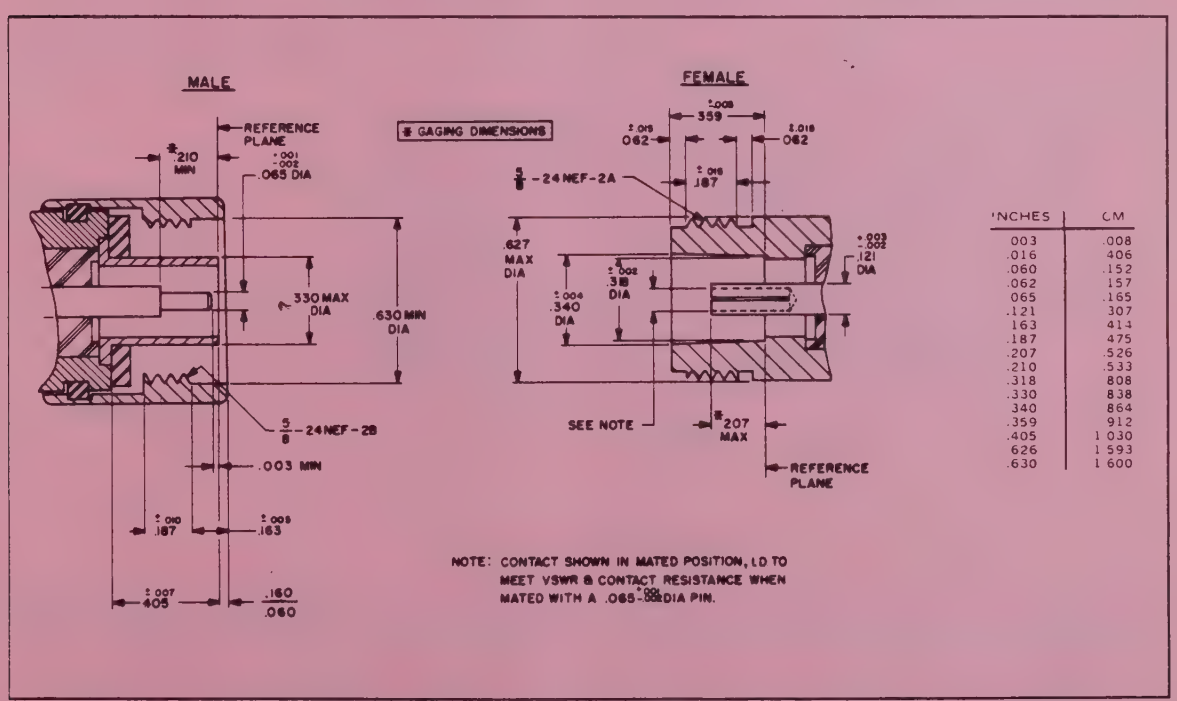


Figure A-2. Important Interface Dimensions for Type N, Class II Connectors (MIL-C-39012/1&2)

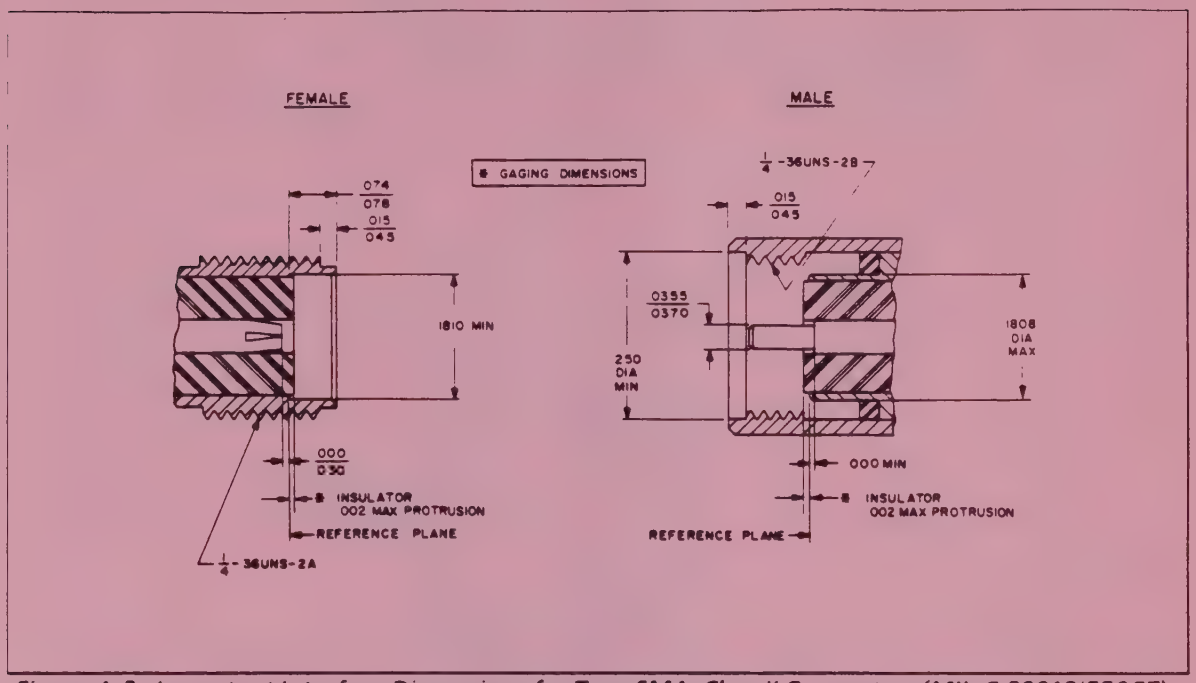


Figure A-3. Important Interface Dimensions for Type SMA, Class II Connectors (MIL-C-39012/55&57)

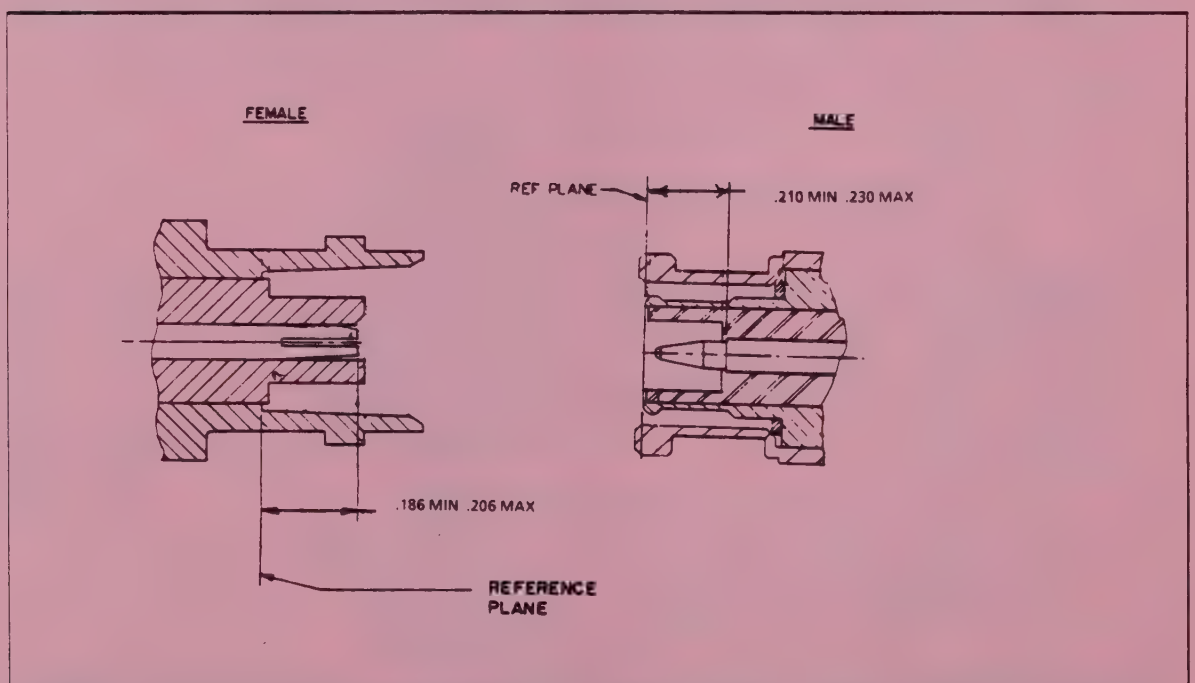


Figure A-4. Important Interface Dimensions for Type BNC, Class II Connectors (MIL-C-39012/16&17)

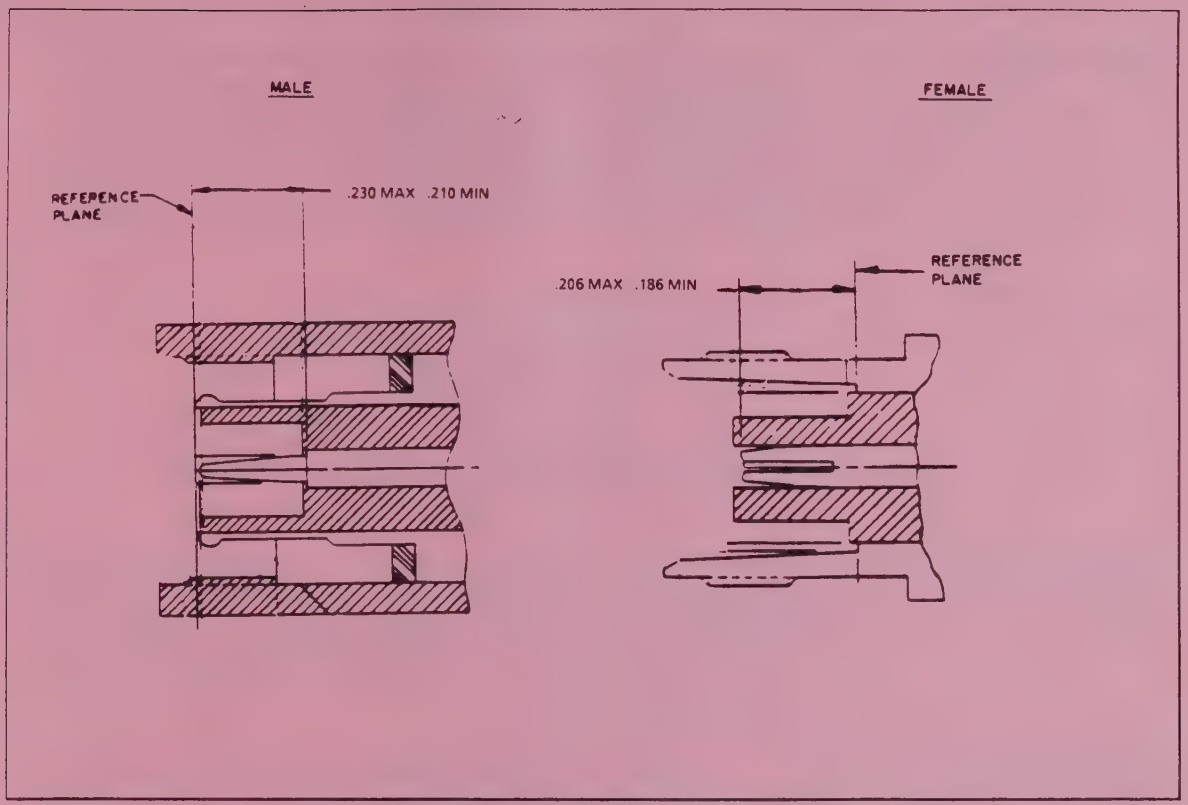


Figure A-5. Important Interface Dimensions for Type TNC, Class II Connectors (MIL-C-39012/26&27)

MATING CONNECTORS

Gently mate the connectors by hand, taking care not to force the coupling nut at the slightest resistance. It is often possible to *feel* whether or not the pins are mated. If the coupling nut is difficult to turn, either the pins are not mated, the coupling nut is cross-threaded, or one of the connectors has been damaged by excess torque.

Never hold a male connector coupling nut stationary while screwing a female connector into it. This rotation can erode the plating and damage both the outer interface rim as well as the pin. If the pins become locked, serious damage can result to both the equipment and the cable assembly.

A-4. ENSURING PROPER CONNECTOR TORQUE

OVERTORQUING

Once connectors have been properly mated, apply only the proper amount of torque. Overtorquing damages both connectors involved. Also, a connector which has been damaged by overtorquing, in turn, damages every connector to which it is subsequently mated. It usually leads to poor system performance as well. Overtorque can cause:

- Bent pins
- Recessed or protruding pins
- Recessed or protruding dielectrics
- Chipped plating
- Damaged coupling threads
- Coupling nut retaining ring damage
- Mushroomed outer interface shells
- Mushroomed pin shoulders

HEX-NUT TYPES

To mate a connector of the hex-nut type, always use a torque wrench set to the correct torque value. Tighten the connector slowly until the wrench *snaps*. Tightening too quickly can cause the wrench to exceed its set limit. Do not snap the wrench more than once as this also causes overtorque.

KNURLED NUTS

Tighten connectors with knurled nuts by hand. If this does not provide sufficient tightness use a hex-nut connector and torque wrench instead. *Never use pliers to tighten a connector.* Table A-2 recommends torque specifications for the various types of connectors.

Table A-2. Connector Torque Recommendations

CONNECTOR TYPE	RECOMMENDED TORQUE
7 mm connector with hex nut	14.0 in./lbs. ± 1 in./lbs.
Type N connector with hex nut	14.0 in./lbs. ± 1 in./lbs.
SMA connector	7.5 in./lbs. ± .5 in./lbs.
WPM	7.5 in./lbs. ± .5 in./lbs.
WPM-3	7.5 in./lbs. ± .5 in./lbs.
WPM-4	7.5 in./lbs. ± .5 in./lbs.
Type N connector (knurled)	hand-tight
TNC connector (knurled)	hand-tight
BNC	hand-tight

A-5. PROPER CABLE HANDLING

Never exceed the minimum bend radius specified for a cable. Guard against tight bends at the end of connector strain relief tubing, or at the ends of marker tubing where they may be less noticeable. Although cable bend may seem slight, the actual radius of the bend at the point of angular departure may be far smaller than the acceptable radius.

Never pinch, crush or drop objects on cable assemblies. Also, do not drag a cable over sharp edges as this will pinch it and cause it to exceed the minimum bend radius.

Never use a cable assembly to pull a piece of equipment. Cables and connectors are not designed to support or move equipment.

SECURING CABLES

Use toothed, rubber-lined "P-clamps" to hold cables in place. If it is necessary to use tie-wraps, use the widest possible wrap and the lowest setting on the gun to ensure the minimum pressure on the cable.

STORING CABLES

When storing cables, minimize cable "set" by coiling them in large diameters (1 or 2 feet). Unroll the cable properly when it is ready to be used; do not pull the loops out hastily. Similarly, re-roll them when storing them away again.

A-6. CLEANING CONNECTOR INTERFACES

Use the following guidelines in cleaning connector interfaces:

A. Do not use chlorinated solvents including common tap water. These solvents are extremely penetrating and sometimes ruin otherwise good devices and assemblies.

B. Moisten a cotton swab with isopropyl alcohol. Roll the swab on a paper towel to remove excess.

C. Use the moistened cotton swab to wipe away debris. Do not try to dissolve the debris by overwetting the swab.

D. Repeat the cleaning process using additional swabs as necessary. If metallic particles are embedded in the dielectric, use an eyeglass and a sharp pick in an attempt to dislodge them. Swab again.

E. When satisfied that the interfaces are clean, blow them dry with dry compressed air, or preferably dry nitrogen (pressurized spray cans work well). Do not use breath.

F. Clean the mating connectors. These may be the source of the debris.

PARTS LIST, ASSEMBLY DRAWINGS AND SCHEMATIC DIAGRAM REVISION LEVELS

Drawing No.	Title	Fig. No.	Rev.	Table No.	Rev.
183-300	1.25 MHz Source Assy.	9-1	A	9-2	A
183-310-000	1.25 MHz Source PCB Assy.,A1	9-2	A	9-3	A
183-310-200	1.25 MHz Source PCB Assy.,A1, Schematic	10-1	A		

MODEL 446A 1.25 MHz SOURCE (IM-188)

REVISION RECORD

REVISION	DATE	DESCRIPTION	APPLICABLE SERIAL NUMBERS
A	July 1986	Initial issue.	100 and above

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